THE
METAL INDUSTRY
WITH WHICH ARE INCORPORATED
THE ALUMINUM WORLD: COPPER AND BRASS: THE BRASS FOUNDER AND FINISHER
ELECTRO-PLATERS REVIEW

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Institute of Metals Division Meeting

A Report of the Meetings and Technical Sessions Held in New York, February 17-20

THE winter meeting of the Institute of Metals Division of the Institute of Mining and Metallurgical Engineers was held at the Engineering Building, 29 W. 39th Street, New York, from February 17-20 inclusive, in conjunction with the regular winter meeting of the parent body. The Division held five sessions in addition to its annual lecture and dinner.

Annual Lecture by Dr. Hoyt

The Lecturer for this year was Dr. S. L. Hoyt of the General Electric Company, who spoke on the subject of hard metal carbides and cemented tungsten carbide. Dr. Hoyt has been working for several years on the development of this material which is known in the trade as Carboloy (for a description of this material see THE METAL INDUSTRY for December, 1928, pages 532-3).

Annual Dinner

The annual dinner was held on Thursday evening, February 20th at 6:30 P. M. at the Savoy-Plaza Hotel. It was attended by one of the largest gatherings ever held of metallurgists in the non-ferrous metal working field. S. Skowronski, chairman of the Division, presided.

ZAY JEFFRIES
New Chairman of the Institute of Metals Division

W. H. Bassett, New President of the Institute

Mr. Skowronski announced to the assembly that W. H. Bassett, technical superintendent of the American Brass Company and past chairman of the Institute of Metals Division, had been honored by election to the office of president of the Institute of Mining and Metallurgical Engineers. The Institute of Metals Division was also honored by this choice as Mr. Bassett is one of the senior members of the Division. Mr. Bassett spoke briefly, expressing his appreciation and pledging his support and friendly co-operation with the Division. He complimented Mr. Skowronski upon his administration and mentioned that he had been appointed to the chairmanship of the Papers and Publications Committee of the American Institute of Mining Engineers, which was a signal recognition of his capabilities and faithful service in the interests of the Institute.

Mr. Skowronski introduced G. E. Johnson, chairman of the Chicago Division who brought the members a greeting from Chicago.

Committee Reports

W. M. Corse, secretary-treasurer, reported that the financial condition of the Division was excellent, and that it had acquired, during the past year, 197 new members, bringing the total membership up to 1294.

R. S. Archer, chairman of the Data Sheet Committee, reported that 91 pages of non-ferrous data sheets had already been compiled and were in the hands of the members. A total of 200 additional sheets were in preparation which would be issued during the next two years with the purpose of compiling a National Metals Handbook in bound form.

Foreign Lecturer

The next foreign lecturer will be Dr. E. Westgren of Stockholm, Sweden, a metallurgist of international reputation, who will undoubtedly present a valuable and interesting paper.

New Officers

New officers for 1930 were elected as follows:

Chairman, Dr. Zay Jeffries, consulting metallurgist, Cleveland, Ohio.

Vice-chairman, John R. Freeman, Jr., U. S. Bureau of Standards, Washington, D. C.

Vice-chairman, Sam Tour, vice-president, Lucius Pitkin, Inc., New York.

Secretary-Treasurer, W. M. Corse, consulting metallurgist, Washington, D. C.

Executive Committee:

H. M. Williams	T. S. Fuller
J. L. Cristie	R. S. Archer
Arthur Phillips	P. D. Merica
G. E. Johnson	F. L. Wolf
W. A. Scheuch	

A new set of by-laws was adopted with eight articles covering the name and object of the division, membership, funds, meetings, officers and government committees,

WILLIAM H. BASSETT,

Past Chairman of the Institute of Metals Division, and Newly Elected President of the American Institute of Mining and Metallurgical Engineers.

nominations and elections of officers, committees, and amendments.

G. H. Clamer was the principal speaker of the evening. He spoke on "The Induction Furnace for Melting Metals," and traced the history of the development of this type of electric furnace, illustrating his speech with lantern slides. He showed the old types of furnaces and their gradual change to the modern Ajax-Wyatt and Ajax-Northrup, covering a period of years of development work at tremendous expense, overcoming what seemed to be insuperable difficulties.

Abstracts of Papers

STRESS-CORROSION CRACKING OF ANNEALED BRASSES

By Alan Morris

1. Coarse grain in so-called "high brasses" appears to lower the resistance of the piece to stress-corrosion attack.
2. Lead and tin in an alpha brass tend also to make the material a little less resistant to this form of attack.
3. The resistance of a Muntz metal, and naval brass (and probably of manganese bronze), is materially increased by quenching from a reasonably low annealing temperature.

The writer does not feel that these tests constitute more than a general reconnaissance of the field. The results are presented in the hope that their discussion will hold suggestions that will serve as a guide to further work of this nature.

A THEORY CONCERNING GASES IN REFINED COPPER

By A. E. Wells and R. C. Dalzell

1. Certain gases dissolve in molten copper with which they are in contact.
2. Parts of the dissolved gases are evolved on solidification, on account of changes in solubility at the melting point of copper.
3. Cuprous oxide in molten copper is colloidally dispersed.
4. Cuprous oxide colloidally dispersed in molten copper adsorbs certain gases.
5. Agglomeration of cuprous oxide particles on solidification liberates parts of the adsorbed gases.
6. Porosity in cast copper is caused by gases evolved from two sources in the molten copper:

a. Hydrogen, carbon monoxide, water, carbon dioxide and nitrogen are evolved on solidification due to changes in solubilities at the melting point of copper. If these five gases are at the same pressure in contact with molten copper, they may be listed as follows in the order of decreasing severity of effect on porosity from this source: Carbon dioxide, carbon monoxide, nitrogen, water and hydrogen. In practice, however, nitrogen probably has the principal effect from this source, as it constitutes about 60 or 70 per cent. of the gases in contact with the copper.

b. Water and carbon dioxide are liberated by agglomeration of colloidal cuprous oxide dissolved on which they are adsorbed. Hydrogen and carbon monoxide dissolved in molten copper tend to reduce any cuprous oxide that is present. The reduction products—water and carbon monoxide—are adsorbed at the surfaces of the cuprous oxide particles at which they are formed. The tendency is slight for dissolved water and carbon monoxide to *migrate* to a copper-cuprous oxide interface. Dissolved nitrogen is not adsorbed on cuprous oxide particles in molten copper.

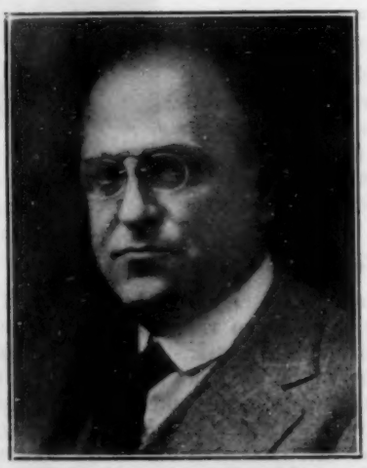
Of the two sources, the second is by far the more important in practice.

7. Sulfur dioxide dissolves in molten copper, partly reacting with it to form cuprous sulfide and cuprous oxide.
8. In furnacing and casting refined copper, the amount of sulfur dioxide dissolved is so small that only small quantities of cuprous sulfide and cuprous oxide are produced. There is insufficient concentration of these in the grain boundaries on solidification to cause the reversal of the reaction, hence there is no appreciable evolution of sulfur dioxide from this source of ore solidification, and consequently no direct effect by the sulfur dioxide on the porosity of the casting.
9. Cuprous sulfide decreases the dispersion of cuprous oxide in molten copper in which both are present. The effect varies directly as some function of the concentration of cuprous sulfide (within the range of concentrations encountered in casting refined copper).

WORKING PROPERTIES OF TANTALUM

By M. M. Austin

The author does not want to give the impression that the working of tantalum under the extreme conditions



S. SKOWRONSKI,

Retiring Chairman of the Institute of Metals Division, now Chairman of the Papers and Publications Committee of the Institute of Mining and Metallurgical Engineers.

described is either necessary or desirable; nor does he attach any practical importance to the behavior of the coarse-grained metal. Ordinarily an effort is made to produce a fine-grained metal and to work it under the most favorable conditions. The facts and figures seem

unusual, and have been given in the hope that they may stimulate discussion and possibly round out the ideas of others regarding the plasticity of metals.

EFFECTS OF OXIDATION AND CERTAIN IMPURITIES IN BRONZE

By J. W. Bolton and S. A. Weigand

Porosity due to incipient shrinkage is influenced by the furnace atmospheres. In this paper the bad influences of actual oxidation are apparent in incipient shrinkage, lowered strength, sluggishness of metal and zinc loss. These remarks apply to metals containing only traces of impurities.

When melted in a crucible under practically neutral furnace atmospheres, the impurities silicon, sulfur and aluminum have effects which do not resemble the usual atmospheric effects. In some cases these impurities have a deleterious influence. Even small percentages of aluminum change the (skin) color of the alloy, and modify its crystallization characteristics. Larger percentages make it weak and brittle, with extremely coarse grain. The inclusions are incidental, if interesting. The hardness is reduced to 57, from 60 to 65. As shown in Fig. 23, the effect is not accompanied by as low specific gravity as is encountered in gassed metal.

SAM TOUR,
Vice-Chairman,
Institute of
Metals Division.

Silicon also appears to go into solid solution and modifies the crystallization characteristics of the metal. When melted under neutral atmospheres, no inclusions attributable to presence of silicon are discernible. While silicon in minute amounts is not dangerous, over 0.05 per cent. should be avoided in commercial practice. In alloys high in lead this element may need to be held even lower.

The action of sulfur is less marked, but in the writers' opinions percentages over 0.05 per cent. are not desirable.

MELTING AND CASTING SOME GOLD ALLOYS

By Edward A. Capillon

1. Defects in gold and silver alloy ingots and their causes have been described.
2. It has been shown that a correctly proportioned mold is necessary in order to obtain ingots which shall give as little scrap metal as possible.
3. Gases in gold and silver alloys produce blisters when the alloy is rolled down and annealed. These gases can be rendered harmless by the use of deoxidizers. The characteristics of various deoxidizers are discussed.
4. Insofar as ductility measured by the Olsen test is concerned casting temperature has apparently little effect on the ductility of rolled and annealed sheet.
5. A summary has been given of the effects of various impurities on fine god. The harmful effect of lead in low-kt. red golds and of sulfur in 14-kt. white gold is shown.

OXIDES IN BRASS

By O. W. Ellis

There is no question that much further work must be done before a definitive statement of the effects of charge, composition, flux, etc., on the "oxide count" of brass can be made. However, it does appear from the author's preliminary investigations in this field that what he has termed the "oxide count" might be used with good effect in the control of foundry practice in certain cases, since so close a relationship appears to exist between the number of oxide particles per cubic centimeter of sample and the character and treatment of the charge. It is quite clear that the conditions both of taking and making test samples would need to be exactly stated in view of the powerful effect of cooling rates concerned in the improvement of their product, this method of control appears to present quite interesting possibilities and to merit further investigation and, possibly, standardization as a test in the foundry industry.

CERTAIN TYPES OF DEFECTS IN COPPER WIRE CAUSED BY IMPROPER DIES AND DRAWING PRACTICE

By H. C. Jennison

Two distinct types of defects occur at times in copper wire as a result of the use of dies of improper design or undesirable wire-drawing practice. The conditions under which these defects may be produced, as well as precautions to be taken in order to prevent them, have been known to the American Brass Company for many years. The quality of the copper wire bars and rods has too often and unjustly been held responsible for these particular defects and it is to correct any such belief that this paper is presented.

RECENT DEVELOPMENTS IN MELTING AND ANNEALING NON-FERROUS METALS

By Robert M. Keeney

Important recent developments in the melting and annealing of non-ferrous metals include:

1. Melting of nickel silver in the vertical ring induction furnace.
2. Electric melting of stereotype metal.
3. The rotary-drum gas-fired brass melting furnace.
4. The low-frequency coreless induction furnace.
5. Finishing annealing of brass sheets with city gas replacing wood in the large brass-rolling mill.

W. M. CORSE,
Secretary-Treasurer,
Institute of
Metals Division.

6. Electric annealing of brass and copper tubing and sheets.
7. Replacement of oil by gas and electricity in the annealing of nickel-silver shells and stampings.

THE ALPHA-BETA TRANSFORMATION IN BRASS

By Albert J. Phillips

When brasses containing from 61 to 62.5 per cent. copper are very rapidly cooled from temperatures near their melting point to below 0° C., unusual results are obtained. These results are quite unexplainable from a consideration of the old copper-zinc constitutional diagram but they can be satisfactorily explained by means of the diagram revised by Genders and Bailey. Conversion from beta to alpha in brass takes place with very great rapidity if there is no change in composition.

G. H. CLAMER,
Who Spoke at the Institute of Metals Division Dinner, on "The Induction Furnace for the Melting of Metals."

COMPARISON OF COPPER WIRE BARS CAST VERTICALLY AND HORIZONTALLY

By J. Walter Scott and L. H. DeWald

1. Vertical casting provides a method of producing copper wire bars which have no wrinkles and oxygen segregation on any long face.
2. Vertically cast copper appears preferable to horizontally cast copper for purposes of wire manufacture.
3. Vertically cast copper is more dense than horizontally cast copper. As would be expected, the bottom of a vertically cast copper bar is most dense, the center less dense, and the top least dense. Regardless of the initial density or method of casting, the density after cold working is approximately 8.91.
4. Wire from vertically cast copper has slightly lower tensile strength than that from horizontally cast copper.
5. Wire from vertically cast copper has a slightly higher per cent. elongation after low-temperature anneal than that from horizontally cast copper. In this regard it is probable that wire produced from the most dense as-cast metal will have the greatest elongation, notwithstanding some of the present experimental results to the contrary.
6. The electrical conductivity of vertically cast copper is higher than that of corresponding horizontally cast copper. The average increase shown by these tests is approximately 0.20 per cent.
7. Vertically cast copper apparently lends itself more readily to processing under wire-mill conditions than horizontally cast copper. The center section of a vertical bar can be processed satisfactorily to both coarse sizes and fine sizes. The top can be processed satisfactorily to coarse sizes, but not so satisfactorily to fine sizes. While the data indicate that the bottom can be processed satisfactorily to fine sizes, but not so satisfactorily to coarse sizes, it is believed that the latter finding is probably due to experimental conditions and can be corrected by modifications in casting technique.

The greatly increased speed being adopted for drawing copper into wire will require copper possessing improved properties. This study indicates that this can be accomplished at least in part by adopting vertically cast wire bars. This change, of course, will necessitate modification in casting technique at the refinery and in rolling technique at the rod mill.

DISTRIBUTION OF LEAD IMPURITY IN A COPPER-REFINING FURNACE BATH

By J. Walter Scott and L. H. DeWald

1. In general, lead occurs more or less uniformly distributed throughout the bath.
2. As the oxidation progresses there is a slight tendency for the lead to concentrate toward the surface.
3. Initial reduction of lead content is easier when larger amounts of lead are present.
4. As would be expected, the oxygen content increases progressively during the oxidation period and decreases with depth.

In conclusion, it is apparent that efficient fire refining methods using slags for removing small amounts of lead from molten copper in a reverberatory furnace must take into consideration two factors: (1) The lead must be in the oxidized condition so that it may unite with the carrier slag; (2) a high degree of agitation must be effected in order that all particles of copper that contains lead may come in contact with the carrier slag.

THERMAL CONDUCTIVITY OF COPPER ALLOYS

By Cyril Stanley Smith

This paper describes the first of a series of experiments to determine the thermal conductivities of all commercial alloys rich in copper. It contains a complete review of previous work, and gives in detail new data on the copper-zinc alloys up to 50 per cent. zinc. The thermal conductivity of the alloys decreases rapidly from 0.941 cal./sq. cm./cm./sec./° C. for pure copper to 0.285 for the saturated alpha solid solution, 39 per cent. zinc. The appearance of the beta phase in the alloys causes an increase in conductivity and a very rapid decrease in the temperature coefficient. The decrease in thermal conductivity caused by adding zinc to copper is not as rapid as the decrease in electrical conductivity, although in general the two curves are similar in form.

ALPHA-PHASE BOUNDARY OF THE TERNARY SYSTEM COPPER-SILICON-MANGANESE

By Cyril Stanley Smith

By means of a series of cooling curves and the microscopic examination of a large number of annealed and quenched samples, the equilibrium relations of the ternary alloys containing more than 90 per cent. copper have been determined. The addition of manganese causes a depres-

DR. SAMUEL L. HOYT,
Who Delivered the Institute of Metals Division Lecture, on "Hard Metal Carbides and Cemented Tungsten Carbide."

sion of the temperatures of the reactions in the binary copper-silicon system, until at 2.5 per cent. manganese the beta peritectic reaction has fallen to 760° C., at which temperature there is a quaternary reaction with MN_2Si. The solubility of Mn_2Si decreases rapidly as the temperature falls, until at 450° C. it is less than 0.5 per cent. with 4 per cent. or more of either manganese or silicon.

CORROSION OF ALLOYS SUBJECTED TO THE ACTION OF LOCOMOTIVE SMOKE

By F. L. Wolf

Results are given of field corrosion tests on various alloys which are not entirely conclusive. They do, however, give an indication of the relative value of various types of alloys commercially available for overhead construction work for steam road electrification purposes.

The conclusion that alloys which stand up well under various other forms of corrosion have failed to stand up when subjected to the corrosive action of locomotive smoke also appears justifiable.

INTERNAL STRESS AND SEASON CRACKING IN BRASS TUBES

By D. K. Crampton

1. The general split-ring method for evaluating internal stress in tubes is only reliable when rather wide strips (*i. e.*, long sections of tube) are used.

2. The copper content of brass tubes has a profound effect on tendency to season crack. Tubes of 90 per cent. copper or over are practically immune and those over 80 per cent. copper are fairly so. Tubes in the high-brass range are strongly susceptible to season cracking. Tubes of 60 per cent. are decidedly the most susceptible.

3. Iron and lead have no practical effect on season cracking. Lead, however, has a very powerful effect on fire cracking.

4. Tin has a slight but distinctly protective effect on season cracking.

5. The reciprocal of the time in minutes to crack in standard $HgNO_3$ solution is a fairly reliable criterion of the tendency to season crack.

6. The tendency to season crack increases directly with intensity of internal stress. Total immunity is obtained when the circumferential stress by the method used is below approximately 12,000 lb. per sq. inch.

7. In high-brass tubes the intensity of internal stress and the tendency to season crack are:

- *A*. Increased by
  - *a*. Increase of wall thickness in proportion to diameter.
  - *b*. Hollow sinking instead of drawing over a plug.
  - *c*. Increase of diameter reduction.
- *B*. Independent of
  - *a*. Rockwell hardness or other physical properties.
- *C*. Decreased by
  - *a*. Increasing area reductions.

8. With properly designed drawing operations it is possible to draw practically any size of brass tube to any degree of hardness and have it free of tendency to season crack. The difficulty of accomplishing this, however, increases considerably with very thick-walled tubes. Tubes so drawn obviously do not require relief annealing to be safe from season cracking.

MONEL METAL AND NICKEL FOUNDRY PRACTICE

By E. S. Wheeler

Monel metal and nickel both being harmfully susceptible to the actions of gases, all possible care should be taken to permit the easy escape of the gases. For the same reason, the use of gas-producing ingredients in molding materials should be reduced to a minimum. Manganese and sulfur are both detrimental, manganese causing the metal to cut the sand badly and causing heavy shrinks while sulfur in excess of 0.030 per cent. makes the metal hot short and brittle. A good grade of refractory molding sand should be used for the molds. Because of their high shrinkage, Monel metal and nickel castings are likely to develop shrinks and pulls which often can be overcome by a change of molding practice, the use of heavier fillets, a change of mixture, the elimination of all or part of the scrap used in the charge, or a change in the core when present to permit the casting to solidify without any strain being set up by the excessive hardness of the core. Scrap should be kept down to a minimum and should not exceed 25 per cent. of heavy scrap or 10 per cent. of light scrap. The use of excessive quantities of scrap is frequently responsible for heavy pulls and sometimes causes porosity, by oxidation of the silicon, which is usually present, and the evolution of gas picked up during remelting.

Melting should be accomplished as quickly as possible but not at so fast a rate as to oxidize the metal. In the crucible pits about 2 hr. should be necessary to melt Monel metal in crucibles contained 175 lb. of metal, and slightly longer for nickel. This melting rate applies to a hot furnace; obviously, the first melt will require a slightly longer time.

The most important factor necessary for the production of good Monel metal or nickel castings is suitable equipment. Without the proper furnaces no amount of good molding or good foundry practice will produce satisfactory castings.

THE INFLUENCE OF SILICON IN FOUNDRY RED BRASSES

By H. M. St. John, G. K. Eggleston and T. Rynalski

1. Very small percentages of silicon in foundry brasses and bronzes containing copper, tin, lead, and zinc have a tendency to produce a coarse dendritic structure, with intercrystalline fissures, which causes castings made from such metal to be weak and porous.

2. Alloys of copper with zinc or tin, or zinc and tin, in the proportions described in this paper, but containing no lead, are hardened and strengthened by the addition of small percentages of silicon. There is no apparent detrimental effect on the structure of the metal.

3. An alloy containing approximately 82 per cent. copper, 8 per cent. zinc, 10 per cent. lead, without tin, is hardened and strengthened by the addition of silicon. The effect on the structure of the alloy is apparently beneficial rather than otherwise but the outside surface of the metal is discolored and pitted by the interaction between silicon and lead.

4. An alloy containing approximately 86.5 per cent. copper, 2.5 per cent. tin, 11 per cent. lead, without zinc, becomes coarsely dendritic, with intercrystalline fissures and segregation of lead, when small percentages of silicon are added to it.

5. An alloy containing approximately 79.5 per cent. copper, 2.5 per cent. tin, 8 per cent. zinc, 10 per cent. lead, to which 0.05 per cent. silicon has been added, becomes very coarsely crystalline and develops large fissures between the crystals. The metal is so bad as to be quite unfit for ordinary casting purposes.

6. An alloy containing as little as 2 per cent. lead with 0.05 per cent. silicon shows the defective structure characteristic of silicon contamination. At 10 per cent. lead, 0.03 per cent. silicon is sufficient to show a detrimental effect.

7. Chill-casting an alloy containing silicon results in a fine-grained structure that is apparently normal. If the metal is cast in green sand at varying temperatures the

effect of silicon on the structure becomes progressively less marked as the casting temperature is lowered.

8. The addition of nickel to an alloy containing silicon progressively reduces the effect of the silicon on the structure, although, with a silicon content of 0.05 per cent., the effect of the nickel is not pronounced until 1 per cent. of nickel has been added. At 3 per cent. nickel the influence of the silicon is apparently entirely obscured and a very fine-grained structure results.

9. The use of an alkali sulfate, such as anhydrous sodium sulfate, or an alkali-earth sulfate, such as barium sulfate, as a flux in an electric furnace, tends to eliminate the silicon by selective oxidation without appreciably affecting the normal constituents of the alloy.

10. The defective structure described, which the authors believe to be the same as that previously described by Bolton and Weigand and termed by them "incipient shrinkage," is not due, in any direct way, to the presence of carbon monoxide in the furnace atmosphere. It can, however, be rectified or prevented by melting the metal under an oxidizing atmosphere, which prevents the reduction of silicon or oxidizes it if already present.

11. The most common source of silicon contamination in foundry brass is by reduction of silicon in the melting furnace. A furnace atmosphere rich in carbon monoxide permits such a reduction to take place if an intimate mixture of finely divided carbon with a siliceous material is present. In the absence of solid carbon there is no evidence of silicon reduction by the carbon monoxide atmosphere.

12. Other occasional sources of contamination are silicon copper or silcion bronze entering into the furnace charge, or silicon carbide used as a refractory in the furnace lining. Trouble from silicon carbide is aggravated by the use of fluxes in the furnace, since these tend to destroy the protective glaze. It also appears that lead has a solvent action on silicon carbide.

13. The authors believe that silicon tends either to obstruct the formation of crystal nuclei in the molten metal or to prolong the period during which part of the metal is molten after it enters the mold. In this way a few crystals grow to large size and the shrinkage of these crystals results in openings or intercrystalline fissures. Incipient shrinkage is probably as good a term as any for this phenomenon. Anything that tends to shorten the freezing time, such as chill-casting, tends to offset the influence of the silicon. The addition of another constituent, such as nickel, which tends to form more nuclei, also tends to prevent the detrimental effect of the silicon.

DIRECTED STRESS IN COPPER CRYSTALS

By C. H. Mathewson and Kent R. Van Horn

As a brief and general conclusion, it may be stated that every attempt to cause the slip on octahedral planes in a copper crystal to take the twinning direction [112] instead of the preferred direction [110] was unsuccessful, so that twinning by pure shear appears to be out of the question in this material.

As to the origin of twin crystals visible after annealing, it may be argued that they occur only after deformation of a complex nature in which slip on one set of octahedral planes is modified by simultaneous slip involving atoms in the same field of attraction on a crosswise set of octahedral planes. Thus, certain [110] rows of atoms originally guided in their slip by adjacent rows must behave differently when these adjacent rows move out of position by slip in another plane.

It is believed that some complication of this sort is responsible for the first appearance of twin bands; in the form of nuclei, which grow into larger bands or become absorbed by other crystals during the course of annealing.

MELTING BEARING BRONZE IN OPEN-FLAME FURNACES

By Ernest R. Darby

Attention is called to the normal chemical actions in open-flame furnaces used in the melting of bronze. Oxidizing, neutral and reducing atmospheres are considered with reference to their effects upon the chemical compositions and physical qualities of the metal melted.

Control of furnace atmosphere, together with close observation of physical properties as determined by routine laboratory tests, makes possible the production of high-grade castings from classes of raw material frequently considered inferior.

X-RAY NOTES ON THE IRON-MOLYBDENUM AND IRON-TUNGSTEN SYSTEMS

By E. P. Chartkoff and W. P. Sykes

In 1926 one of the authors published researches on the determination and description of the iron-tungsten and iron-molybdenum systems, including the equilibrium diagrams. In 1929, further work was carried on, including the examination by X-rays, which is recorded here. Measurements were made of changes in lattice parameters in the solid solutions. Precipitation from the solid solution and the accompanying changes in hardness were studied; also the formation of the compound phases upon sintering a mixture of metal powders.

INFLUENCE OF CYCLIC STRESSES ON CORROSION

By D. J. McAdam, Jr.

This paper discusses the influence of cyclic stress on corrosion of carbon and ordinary alloy steels, corrosion-resisting steels, Monel metal, and aluminum alloys. The damage due to corrosion is estimated by comparing the fatigue limit of the previously corroded specimen with the endurance limit of the metal. Specimens are corroded with or without cyclic stresses of various frequency, and for various times. The corroded specimen is then oiled, its fatigue limit is determined and compared with the endurance limit of the uncorroded material. The lowering of the fatigue limit represents the "damage."

The results of the investigation are expressed in diagrams of various types illustrating the relationship between corrosion-stress, time, number of cycles, and either total or net damage. By "not damage" is meant the total damage loss the damage that would be caused in the same time by stressless corrosion. The effect of cyclic stress on corrosion is measured by net damage rather than by total damage. Relationship of net damage to corrosion stress, time and number of cycles, may be represented on a logarithmic scale by nearly straight lines.

ELECTROLYTIC CADMIUM PLANT OF ANACONDA COPPER MINING COMPANY AT GREAT FALLS, MONT.

By W. E. Mitchell

A general description of the methods of producing electrolytic cadmium in the largest plant of its kind in the world. The methods are described from the extraction from zinc ores, the production of cadmium sponge, leaching said sponge with sulphuric acid and electrolysis from the sulphate solution. A subsequent melting is done in an electric melting pot furnace.

STUDIES IN METAL CRYSTAL ORIENTATION

By Thomas A. Wilson

A method has been described by which it is possible to find rapidly the orientation of single-crystal specimens from which only Laue photographs can be obtained. These Laue photographs are obtained with high-voltage X-rays. The photographs are solved either by the application of the gnomonic projection alone or by the application of the stereo graphic-gnomonic double net.

Factors Affecting the Quality of Zinc for Galvanizing

A Discussion of This Problem Based on Practical Plant Operation and Analyses of Various Brands of Slab Zinc in the Laboratory

By WALLACE G. IMHOFF
President of The Wallace G. Imhoff Company, Pittsburgh, Pa.

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

THERE are two features of paramount importance regarding zinc for galvanizing. These are quality and cost. Attention is called to the fact that quality comes first and not cost. As a matter of fact this may also be stated in another way; namely the physical and chemical characteristics, and the cost. One of these is important to the purchasing agent; the other to the man in the shop who uses the zinc. The purchasing agent is interested in the cost; the galvanizer in the quality of the metal.

It is very interesting to again discover the old known fact that "you cannot get something for nothing"; in this case it happens to be zinc. For the sake of example, it will be demonstrated that zinc cannot be obtained for nothing, or to reverse the condition, to obtain quality zinc, it is necessary to pay a higher price. The question then finally resolves itself into, "Does the man who pays 6½ cents a pound for zinc get more than 6½ cents worth of value; and does the man who pays 6⅝ cents a pound get a full 6⅝ cents worth of value." The answer to the first question is "no"; the answer to the second question is "yes"; granting that both sellers are reliable companies.

This is exceedingly interesting since many times when the purchasing agent has saved in buying, a check up of actual results and facts in the shop, show that the difference in quality is made up for by other factory costs, not known to the purchasing agent. The practical man knows them because he is dealing with them, and quality registers in dirt, in dross, and in a high quality coating, and seconds and work that has to be regalvanized.

To be specific take two metals at a difference of an eighth of a cent a pound. The higher priced zinc is higher priced, for definite specific reasons based on quality. A consideration of these qualities for which an eighth of a cent more is asked in the slab zinc, is of particular interest, because a saving of an eighth of a cent in the slab form, may be the cause of the spending of 2 or 3 cents more in the processing. Whether it is two or three, or just how much, cannot be definitely stated, but actual practical experience in handling the two grades of zinc in the smelting process of zinc as carried out at different in quality and results obtained.

The facts are registered from the start. The first place is at the manufacturer. There is a considerable difference in the smelting process of zinc as carried out at different smelters. If it is not known how to judge, or determine the quality of the metal, the best thing then to do is to deal with a very reliable smelter, or buy a better brand of zinc, and pay the price. This is no reflection on the manufacturer; it is merely calling attention to the fact that superior products command better prices.

The physical appearance and the handling of the metal in the galvanizing pot show many characteristics. For example, in starting a new kettle very careful records were kept in regard to accumulation of the dirt which came out of the metal in melting it. The total metal charged was 78 tons (156,000 lbs.), and the dirt which was scraped off before galvanizing could be started was 1785 lbs. This is equal to 1.14%. Thus for 1.14% of this zinc 6.50 cents a pound was actually paid for as metal. In reality it was dirt, and caused additional expense, by requiring time and labor to remove it from the bath.

Another actual example showed about 800 lbs. of dirt from 38.6 tons (77,200 lbs.) of freshly melted zinc in a new pot, or about 1.03% of dirt, which was bought at the price of metal. For the sake of argument and example, suppose roughly that 1.1% of the zinc is dirt. One ton of zinc at 6.50 cents would cost $130.00. But $130.00 does not buy a ton of metal, but only 1978 lbs. The actual cost therefore is about 6.57 cents a pound, and on 78 tons the difference is about $109.20.

Figures from a very high quality zinc show less than one half of one percent of dirt after melting it. The physical characteristics of this zinc also show a clean smooth slab of metal which has a bluish to silver-white lustre. The top of the slabs are perfectly smooth and clean, and show absolutely no discoloration. The fracture is bright, and crystalline, with very large flakes, shining and glistening as the light plays on them. The metal in the pot is clear, like a mirror and stays clear. It is fluid and has what the practical galvanizer calls "life to it." This is good high quality metal; and costs a little more than the average slab zinc.

The physical quality of the cheaper metal is reflected in the heavy scum found on the surface of a large number of the slabs. The slabs are rough, and many of them are seen to be discolored to a blue, or purple color. The fracture of the metal when broken is not clearly crystalline, and there are fine spots in it. At the chill marks the fracture is often seen to be almost silky fine, and the color yellow, or even blue. The dross production is high, and the metal is "dead." Zinc skimmings run higher, and a large amount of the work is returned as seconds to be regalvanized.

These few remarks crystallize the thought into the question, "what are the differences in the qualities of a high grade zinc and a low grade zinc?" This question may be summarized as follows:

1. A difference in the dirt in the metal.
2. A difference in the chemical contents.
3. A difference in the physical characteristics.
4. A difference in dross production.
5. A difference in oxide, or skimming production.
6. A difference in the "life of the metal."
7. A difference in the specific gravity of the zinc.
8. A difference in the pouring temperature of the metals.
9. A difference in the cost of the metals.
10. A difference in operating temperature of the galvanizing pot. The temperature can be lower with purer zinc.
11. A difference in production.
12. A difference in the quality of the coating and the quality of the product in general.
13. A difference in the weight of coating; the coating is lighter with purer zinc.
14. A saving in fuel due to lower operating temperature.
15. A difference in pot life due to lower operating temperature
16. Fewer seconds and regalvanized articles.
17. Less scum and scruff in the coating.
18. Smaller, threaded articles can be coated.
19. The coating is more ductile with purer zinc.

Three additional factors may be:

1. A heavy white coating over the metal.
2. The zinc is "remelted" zinc.
3. The zinc is "reclaimed" zinc.

Each one of these points will be briefly discussed. The dirt, or skimmings from the average brand of slab zinc will average about 1.00 to 1.20%. In very high quality zinc the dirt will only average about 0.50% or less. Another actual test on melting in 46,360 lbs. of high quality metal showed 200 lbs. of skimming made, or about 0.43%. Naturally the price was higher for this better quality zinc.

Dirt and oxide in the zinc tends to reduce the fluidity ("life") of the metal and make it sluggish. Also when putting in new slabs of zinc the dirt comes to the surface and in many instances this dirt and scum are caught on the article and dragged out in the coating. It is harder to keep this scum and dirt out of the coating with poor grade metal.

Prime Western Zinc according to standards set up by the American Society for Testing Materials is zinc which does not contain over:

1.60 percent lead.
0.08 percent iron.

The actual analyses of many zincs show some to be very high grade metal, and others not to fall within the limits of Prime Western Zinc. It is therefore only good business practice for those using Prime Western Zinc to see that they are getting that quality by having check analyses made.

During the war the shutting out of German and Belgian production caused such enormous increase in the demand for American Zinc, that the American producers, as if by common consent, automatically discontinued all guarantees of the purity of Prime Western metal. They stated, and it was undoubtedly true, that the extraordinary conditions did not permit the same careful smelting practice as before, and that furthermore on account of the quantity of low grade ore that they were obliged to also allow an increase in lead content. Therefore, for about a year and a half, zinc containing 2 to 2½% lead was passed as Prime Western Zinc with only an occasional protest on the part of the buyers. Excess iron has been a less common occurrence, and naturally so, but often the metal did run as high as .10% in iron. Since the war, however, the zinc situation has radically changed, and is now back again to a more normal basis. Most metal is good metal and falls well within the limits of the chemical contents required for that brand of zinc as set forth in the standard specifications. There is, however, like in all other materials, still a difference in the quality of zinc, and it is from this standpoint, and not the former distorted one based on war conditions, that this article is written.

The analyses of five different brands of zinc which did not fall within that specified as Prime Western by the American Society for Testing Materials are given below:

	% Tin	% Lead	% Copper	% Iron	% Zinc
1	.018	.560	.000	.150	99.272
2	.037	.690	.000	.287	98.986
3	.012	.900	.000	.316	98.772
4	.059	1.690	trace	.165	98.086
5	.007	.020	.000	.694	99.279

The analyses of five different brands of zinc that do fall within the specifications are given below:

	% Tin	% Lead	% Copper	% Iron	% Zinc
1	.008	0.270	.000	.064	99.658
2	...	1.270	...	.03	98.700
3	...	1.250	...	.045	98.705
4	...	0.156	...	.046	99.798
5	...	0.520	...	.020	99.460

The difference in physical characteristics of zinc can only be recognized by those familiar with zinc smelting. Metals are like individuals, they have special marks of identification by which the quality can be recognized by those who can properly interpret those marks. The surface of good zinc is clean and smooth. It is not filled with scum, cracks, blisters, discoloration, etc. The fracture across the full slab section (not the chill marks) shows large shiny, open crystals, not fine grain which is yellow, blue, and other colors. Good zinc is fairly tough in slab form; poor metal is brittle and breaks easily. Good metal coalesces easily; the metal quickly and easily runs together. The metal is sharp looking, clean and glistening.

The practical galvanizer may not know what the chemical analysis of his metal is, but he knows when he drosses when using some brands of zinc that he gets far more dross than when using other brands. A check up for quality of metal has invariably shown metal purchased at a lower price. It is extremely important that the man in the shop and the purchasing agent work together because the cheapest material at the start is often the most expensive at the finish. High quality raw material must of necessity command a higher price. The factor of importance is to know which materials are the high grade materials, so that the average grade will not be purchased at high grade prices.

As a general rule high grade zinc does not produce the total oxide and skimmings that average metal does. Average metal usually gives a much higher quantity, about twice as much dirt, when first melting in. Also during operations average metal usually produces considerably larger quantities of skimmings.

High quality zinc has what the practical galvanizer calls "life to it." This is the practical way of stating that the metal itself does not have very much oxide dissolved in it, or held in it. The metal is glistening, clean, very fluid, freezes slowly, and coalesces easily. "Dead" zinc freezes quickly, is brittle, melts at a higher temperature, and tends to be thick, and not coalesce easily. Zinc which is full of "life" gives a good zinc coating, is easy to handle and work, produces minimum of by-products, and under ordinary conditions gives a high quality product.

A very interesting fact about high quality zinc and average zinc which is not generally known, or even suspected, is the difference in specific gravity. Clean high quality zinc has a lower specific gravity as shown by the specific gravities below:

Specific Gravity High Quality Zinc	Specific Gravity Average Zinc
7.05	7.21
7.00	7.23
7.02	7.69
7.10	7.38
7.13	7.19

The specific gravity of zinc as given by Haswell is 7.19 while the best representative average specific gravity of zinc is 7.142. The specific gravity of zinc was found by W. C. Roberts-Austen to change from 7.2 to 6.51 when melted; this corresponds with a contraction during solidification. C. M. Marx and F. Mes and A. Winkelmann noted the contraction of molten zinc on the act of solidification. According to M. Topler, a gram of zinc expands 0.010c.c. in passing from the solid to the liquid state. L. Playfair and J. P. Joule gave 6.512 for the specific gravity of melted zinc.

The better the quality of the zinc is, the lower will be its specific gravity. Lead, tin, and iron all tend to increase the specific gravity of zinc. These impurities are often found in commercial slab zinc.

The difference in pouring and handling temperatures of zincs at the smelters may be easily recognized by the discoloration of the slab. High quality metal is always clean, smooth, and has a silver white to blue lustre. Metals which have been overheated at the smelters are yellow, blue, and purple. This is due to the formation of the oxide at the higher temperature. All metals whether

zinc, iron, copper, etc., have a correct pouring and handling temperature. It is usually about 20 to 50 degrees above the melting point. This gives fluidity and coalescence, and tends to purify it by making it thin and fluid, thus floating or driving the higher oxides out of the metal to the surface. Too high a temperature oxidizes the surface, and if too far beyond the proper temperature, the metal will take up oxygen and be filled with oxides. This decreases the fluidity of the metal, takes the "life" out of it, and does not give a high quality metal.

The difference in costs of various brands of zinc are usually based upon the above facts which are known to those smelters making, and specializing in high quality product. It actually costs more to make this high quality metal, since the waste is taken as a loss in smelting cost, wherein the average grades which are not handled so carefully, this dirt is sold to the consumer at the price of the metal. A lower price can therefore be asked since the loss is passed on to the consumer. As a general thing all zincs as stated before are now usually within the limits of Prime Western Specifications but the Specifications do not mention the other features such as pouring temperature, discoloration, fluidity, influence on dross production, "life" etc. These are practical factors of smelting which cannot be definitely stated in tangible form, although they are known to exist.

Additional factors of slab zincs for galvanizing are a heavy white powdered deposit often covering the zinc, and whether the zinc is "remelted," or "reclaimed" zinc.

The white deposit on zincs is usually found in the fall of the year when it is damp and the air is high in moisture. Often the car leaks and the zinc during shipment has been wet, and the car full of dampness and moisture. This is the cause of the white deposit which is zinc oxide when dry. Moisture ordinarily attacks zinc slowly in the open, but when confined in the form of dampness the attack is very rapid. Even finished galvanized articles which have the coating set by water cooling quickly form this white deposit when water, or moisture is confined on the article in storage. Zinc should not be kept or stored in a place where it will get wet, or where dampness can settle on it.

A few years ago, during the war period when zinc was scarce and hard to get, the question of using "remelt" zinc became a live one. Zinc is like money which may be spent wisely or foolishly. There is no harm in money; it is the way money is used. The same is true of zinc, there is no harm in using remelted zinc, if the zinc has not been overheated, or contaminated. The writer has used remelted zinc from a reliable dealer, and there are a number of companies using this metal with satisfactory results. The metal falls well within the limits and specifications of Prime Western Zinc, and has been found perfectly satisfactory from all other standpoints. However, during the war period remelted zinc could not be used because it was so high in iron, and the general quality of the zinc was so poor as to make it unfit for galvanizing. The analyses of a good brand of "remelted" zinc showed: lead 0.98; iron 0.05—both are within the limits of Prime Western Zinc.

"Reclaimed" zinc is zinc sweated from dross. This is usually very high in iron content because the dross requires a high melting temperature. Some of this kind of zinc showed an iron content of 2.00%. Zinc will take up a larger quantity of iron in chemical combination at higher temperature, than it will at lower temperature. "Reclaimed" zinc can be good zinc, if the temperature of the reclaiming pot is never allowed to go over 830 to 840 degrees F. The lower the temperature, the better the zinc reclaimed. Failure in this respect has invariably been traced to too high a temperature in the reclaiming kettle.

Due to the difficulty of obtaining pure metal in practice, the use of "remelted" zinc and "reclaimed" zinc is not recommended.

In conclusion it may be stated that high quality zinc:

1. Contains a minimum of dirt.
2. Shows the proper chemical analyses.
3. Is physically clean, smooth, and highly crystalline.
4. Produces little dross.
5. Contains little oxide.
6. Has "life" to it.
7. Is of low specific gravity.
8. Has a silver white to blue lustre.
9. Costs the same, or slightly more than the average commercial slab zinc on the market.

Etched Name Plates

Q.—We are contemplating the manufacture of etched name plates in brass and aluminum. We have been manufacturing, for some time, name plates in aluminum which were not etched, similar to the small sample enclosed herewith. We are entirely unfamiliar with the processes of etching in quantities. How is this done?

A.—Make a black and white drawing of the number of plates to be made from the sheet of metal. Reduce to size by photographing on glass negative. Transfer photograph to a zinc plate sensitized with this solution:

Whites of two eggs	
LePage photo-engraver's glue.....	½ oz.
Aqua ammonia	¼ oz.
Distilled water	16 oz.
Bichromate potash 3½	grams

Beat up the eggs, glue and ammonia in one-half the water, and dissolve the bichromate in the other half and mix. Allow to settle. The zinc plate so treated forms the master plate.

This master plate is now coated with printers' ink and dusted over with a resist made up of:

Yellow resin	2 lb.
Asphalt	4 lb.
Beeswax .....¾	lb.

This is made by melting together; when thoroughly mixed pour into cold water to chill and break it up. Dry and grind to a very fine powder.

After dusting master plate with this resist, brush off surplus with a camel hair brush and heat sufficiently to melt resist on high lights. Etch zinc plate in solution of 1 part nitric acid to 10 parts water.

A saturated solution of gum arabic in water is then brushed over the etched portion of the plate to prevent ink sticking to the etched ground when inked for transfer. The plate is dried and the resist removed with water.

The master plate is now ready to put on one end of press bed and the brass sheet at the other. The master plate surface is coated with ink with a printer's roller and the impression taken off and transferred to the brass plate, which is then dusted over with resist, surplus removed with camel hair brush and heated to melt the resist.

The batch of brass sheets so prepared is then ready for etching in a perchloride of iron solution. After etching, the background is blackened by plating with black nickel or the carbonate copper-ammonia black, the resist removed in a warm weak soap solution, dried, and lacquered.

In etching the plates it is general practice to provide a rack in the etching tank so that the plates may be set up on edge and the rack oscillated to get faster etching action and smoother etching. —Walter Fraine.

Quality Production of Pewter Hollow Ware

How the Work Is Carried on at the Derby Silver Company, Derby, Conn.*

By F. A. WESTBROOK
Mechanical Engineer

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

At the plant of the Derby Silver Company, at Derby, Conn., which is one of the units of the International Silver Company, large quantities of pewter hollow ware are manufactured. The processes are on a production basis and at the same time the quality is of the highest order. While the methods of fashioning the hollow ware shapes in pewter are substantially similar to those used with the base metal for plating, yet there are several differences in detail due to the fact that the nickel silver alloy used for plating cannot be handled just the same as the 92% tin, 8% copper alloy, of which the pewter consists. The best way to see just what is done in the plant is to follow the processes from raw material to finished product.

In the first place the designs are either direct copies of the finest examples of old pewter taken from the Boston Museum or other exhibits including English, French and Scandinavian, or they are based on the design of such pieces. This matter of design is in charge of a special department whose members make a study of the old pieces both from books and at the museums. This department also makes the original drawings and supervises the making of the moulds, spinning chucks and dies for the experimental pieces and from which the tools for production in the factory are made.

Scratch Brushing Pewter Ware at the Plant of the Derby Silver Company

Washing the Pewter Ware. This Is Done Several Times During the Process of Production

When it comes to manufacturing, it must be borne in mind that some pieces are very much more complicated to make than others. For example, some shapes are spun directly from a flat disc. Others are first partially shaped in a "dishing" machine, or hydraulic press, and then spun. This saves time in spinning and reduces the cost of production because the "dishing" operation is very short. Still other pieces are made in separate sections which are soldered together and some of these sections may be cast in moulds. So it will be seen that there are several lines of production and that the coordination of these lines calls for a well organized personnel.

The casting department seems the logical one to start with. As many pieces, shapes and parts as possible are cast so as to save spinning, and therefore expense. The pewter is delivered in the form of 100 pound pigs by the Company's mill, known as Factory R, and is melted in pots heated by coal fires. This alloy, of course, has a low melting point and very careful temperature control is maintained. In casting a handle, for instance, or the bases of some particular pieces, it is desirable to have them hollow so as to reduce weights, a result which is obtained by very simple means. A metal mould is used and when the molten pewter has been poured in the outside of the mould is cooled slightly with water. With the liquid pewter at the proper temperature, this cooling just hardens it in an outside shell while the center remains in a fluid state. When, therefore, the mould is tipped, this fluid metal may be poured out, thus leaving the casting hollow. This is the process known as "slush casting."

Many of the moulds, especially for the more complicated designs, are made in sections so that the casting may be easily removed. Where the designs are of an elaborate character, the castings are made under pressure in order to secure sharp lines.

We next come to the metal cutting and rolling department where the sheet pewter is prepared for spinning. These sheets are delivered from the company's rolling mill in Meriden, Conn. As already stated a good many pieces are spun directly from discs which are cut on the circling machine at the Derby Silver Company. There is also a "dishing" machine which partially shapes the pieces of certain designs so as to save on the spinning operation, also located in this department. It consists

* This article is the second of a series on Pewter. The first was published in our issue for February, 1930, pages 64-66.

of a hydraulic press provided with proper dies which presses the metal into shape, in some instances with a sheet of heavy rubber interposed between the metal and the die. Striking pewter as is done in an ordinary punch press or even pressing it without the rubber mat is likely to tear it. Of course where only a rough blanking out of some very simple shape is called for, an ordinary press is used.

Before any spinning takes place the pewter is tempered. The discs or "dished" pieces are placed on a gas heating

A Spinner at Work on a Pewter Article

plate, heated to a low temperature and then quenched in water. This is done to strengthen the metal so that it will spin properly. In spinning pewter it is necessary to work the metal from the top of a goblet, let us say, toward the bottom in order to obtain an even thickness, for if it is done the other way round, the top will be thicker than the rest of the side, or it will have to be lengthened out and cut off, thus wasting metal. By working back from the top the excess metal will be in the base

Pewter Ware

where it is desirable to have it. A good spinner can tell by the feel just where the metal is going.

After spinning, comes the turning operation in which the piece is placed in a lathe and gone over, outside and usually inside, with a more delicate tool to produce a clean and fairly smooth surface for later polishing. In some cases the inside of the piece is turned before spinning is finished because, as may easily be imagined, it is impossible to get inside of a good many of the finished shapes with a lathe tool. In some cases the pieces are finished as to shape by pressing instead of spinning, which saves time and labor. Round castings are also taken to this department for the same purpose. In this case the turning operation results in making the outside surfaces concentric with the hollow interior, which is of importance in some instances and not necessarily so in others where a fitting together of parts is not dependent upon it. Hand beating and chasing is done next in a special department if the design calls for it. Where plates, etc., have irregular edges the latter are cut out with a band saw especially adapted to sawing pewter.

All pieces made up of two or more parts which must be soldered together are assembled in the soldering department. The castings, of course, are first scraped if they are of a shape which cannot be finished off in the turning department. This is all hand work. After soldering, the

Pewter Ware

pieces are washed to get rid of the soldering flux and they are then sand buffed and polished with tripoli; called "cutting down." However, with shapes having handles and the like, the latter cannot well be soldered on until after the tripoli polishing operation because they would be a hindrance to both the buffing and polishing.

After the "cutting down" the pieces are given another washing, then their high finish or "coloring" tripoli polishing. There is a final washing after this and then the "scratch brushing" with a soft wire brush and pumice and water to obtain the soft lustrous finish.

While it will be seen from this brief description that machinery is freely used in the production of modern pewter to an extent which would incur the severest disapproval of the ancient guild pewterers, yet in comparison to many other manufacturing operations of modern times, there is a great deal of hand work. It is also evident from a visit to a plant of this kind and from observation of the workers and processes employed there, that an unusual amount of skill and craftsmanship is called for and exhibited. Certainly the tradition of the pewterers' guilds has not been lost so far as ultimate results are concerned.

Development of Electric Zinc Melting Process

Ajax-Wyatt Induction Furnace Used for Casting Zinc Slabs at Atlantic Zinc Works, Brooklyn, N. Y.

By W. R. MANNY and WILLIAM ADAM, JR.

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

METALLURGISTS have for years recognized that zinc is one of the most difficult metals to work. The properties of iron, steel, copper and many other essential metals have long been understood and applied commercially in the production of uniform alloys, whereas even in the most up-to-date zinc rolling mills, baffling imperfections in the finished product continue to occur. The manufacturing process of rolling sheet zinc

Fig. 1.—One of the Old Oil-Fired Furnaces with Two 1,000-Pound Graphite Crucibles.

is quite similar to that used in making other sheet products, such as brass, copper, etc. It consists essentially in first casting a suitable zinc slab, approximately 10″ x 20″ x 1″. After being carefully inspected for surface defects, the slabs are placed in an annealing furnace where they are maintained at a uniform temperature for twenty-four hours. This annealing process provides the proper crystalline structure for the first—or break-down—rolling operation. The original slabs after passing through these rolls are reduced in thickness to about ⅜ inch. The plates coming from the break-down rolls have their edges trimmed and are annealed again for the finishing rolls. The finishing rolls then reduce the plates to the various gauges required by the industry.

In addition to an inspection for surface defects between each of the above operations in the plant of The Atlantic Zinc Works, devoted exclusively to the production of the finest sheet zinc for photo-engraving, a careful inspection of each sheet is made for uniform thickness, flatness, temper and etching qualities. The plates are then shipped to the grinding and polishing plants. In spite of the most careful inspection of the cast slabs, the majority of defects can be detected only after the final rolling operation. Small pin holes in the original slab then appear as elongated streaks. Obviously the most important and difficult step to control in the production of the high grade zinc alloy necessary for the photo-engraving plates is the melting and casting of the original slab before rolling.

To obtain proper mixture and some heat control, it has been customary to melt the several elements necessary in a photo-engravers zinc plate in several 1,000 lb. graphite crucibles in oil or coal fired furnaces. After melting, and mixing by hand, the molten zinc was removed from the crucibles by means of iron ladles, carried to the molds and poured—all by hand. Mixing and temperature control were at best uncertain and even an experienced, highly skilled caster, tended to slacken in his close attention to the many essential details. The heat being absorbed through the lining of the crucibles could not be instantly controlled and as a result the metal near the walls of the pot would tend to burn. This overheating was due to the excess heat being absorbed through the lining of the crucibles as the pot was emptied by the ladles. The all important pouring time varied with the skill and alertness of the caster. In order to pour at the proper temperature, the crucibles had to be heated above the ideal point to allow for a rapid drop in temperature during the ladling and pouring. No method of control could make proper provision for the excess heat around the walls of the crucibles while melting, nor for the variable drop in temperature while ladling. As a result, there was always a variation in the texture of the slabs which, unfortunately, could not be surely detected until the etcher had completed a costly photo engraving on the finished plate.

It was finally decided to investigate the possibility of utilizing an electric melting furnace Various types were considered, but it was concluded that the vertical ring induction furnace offered the greatest potential possibilities. This furnace had proved a pronounced success in melting brass and bronze alloys, many of which contained a large percentage of zinc. Not only did its principle of operation appear to be the most ideal for zinc melting, but it also could be readily adapted for pouring directly into the molds. Accordingly, an Ajax-Wyatt Induction Furnace was installed in the summer of 1929, and all of the zinc sheet manufactured in this plant since Septem-

Fig. 2.—The Old Method of Casting Slabs. The Metal Is Carried from the Furnace to the Molds in Ladles

ber has been made from slabs cast from this electric furnace. The advantages of placing the casting operation under positive electric control were immediately apparent. The plates melted and cast from the electric furnace are uniformly equal or superior to the very best plate ever obtained under the old process. The merits of this new system of melting zinc will perhaps be better appreciated by considering the principle on which the electric furnace operates.

Figure 3 shows a vertical cross section of the induction furnace. It operates from a 220 volt, 60 cycle, single phase source of power, supplied from a standard outdoor

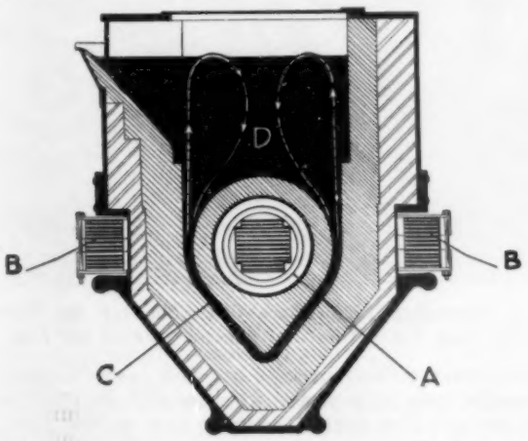


Fig. 3.—Cross-Section Diagram of Electric Zinc Furnace

transformer. When a voltage is impressed on the primary coil "A", the furnace transformer "B" is energized. This induces a low voltage, approximately 5.5 volts, in the "V" shaped melting channel "C" which is always filled with the molten alloy, and acts as the secondary of the furnace transformer. A current of relatively high value flows in the "V" shaped channel—about 16,000 amperes—and due to the resistance of the molten zinc, heat is generated at an absolutely constant rate. At the same time the strong magnetic field about this channel sets up electrodynamic forces which eject the hot metal out of the channel which in turn is replaced by colder liquid metal from the bath "D" above the melting channel. This automatic circulation follows the path shown by the arrowed lines in Figure 3. The result of this internal stirring action is that the zinc bath is thoroughly mixed insuring perfect alloying without any mechanical aid. The zinc used for photo-engravers sheet contains a small percentage of other metals, such as lead, cadmium, etc., and the thorough mixing action of the electric furnace has resulted in an even distribution of these elements through the metal.

Since the heat is generated directly in the metal itself, there is no heat lag. The metal bath is the hottest part

Fig. 5.—Showing the Thermocouple Placed in the Bath of Molten Zinc in the Induction Furnace

of the entire unit, which is just the reverse of the condition existing in the former fuel fired pots where there was a great temperature drop through the walls of the crucible, so that the metal around the walls was always much hotter than the metal in the center of the crucible. In the induction furnace there is an instant response in temperature of the metal bath when the power is thrown on or off. When the power is shut off, the temperature of the bath cannot continue to increase because there has been no heat storage at a high temperature in the refractory walls during the melting cycle. In the old crucible practice, however, the temperature of the metal continued to increase after the source of heat was removed, due to the fact that heat had been stored in the crucible walls at a temperature much higher than the ideal pouring temperature of the zinc.

The constant power input in this furnace, from the beginning to the end of the melting cycle, insures a uniform melting rate. At the present time 950 pound heats are being poured. The furnace draws a steady load of 62 kw., and it required 40 minutes to melt each heat. Compared with the fuel fired furnaces, there is an uncanny clock-like precision with which the electric furnace produces heat after heat in exactly the same time, without requiring any mechanical or electrical adjustments on the part of the operator. The thermo-couple is inserted in the metal bath near the end of each heat, and at exactly

Fig. 4.—Casting Zinc Slabs with the New Electric Furnace

Fig. 6—Placing Slab Zinc in the Annealing Furnace

the ideal pouring temperature, the induced melting current is reduced to a value just sufficient to maintain this ideal temperature while pouring, eliminating the variable timing of the old hand ladling process. This low holding current is obtained by means of an autotransformer which may be connected into the circuit and provides low values of voltage.

A counterweighted tilting mechanism is used to pour the furnace. The tilting axis passes through the pouring lip, so that the stream of metal impinges on one point for all positions of pouring. The casting molds are mounted on a revolving turntable, so arranged that each mold passes directly under the pouring spout of the furnace. This arrangement not only eliminated the cumbersome and expensive hand ladling system, but also provided a method of pouring the metal into each mold at exactly the same temperature.

Due to the close temperature control, the drosses are extremely low, averaging less than ¼ of one per cent of the metal charged. In fact, it has not been found necessary to use any flux or slag whatsoever on the metal surface. The automatic stirring action also brings any dirt or foreign matter to the top of the bath where it is skimmed off prior to pouring. Since the furnace has a refractory lining, the zinc bath is never in contact with any iron, so that it is impossible to contaminate the metal with this undesirable element.

During the five months in which the electric furnace has been in operation, the maintenance cost has been practically nil, whereas the old crucible fires entailed considerable maintenance expense. The crucibles had an average life of six weeks, or a metal production of about 125,000 pounds. The electric furnace has already produced close to 2,000,000 pounds and the refractory lining still appears to be in perfect condition. The labor required per ton of metal cast for the electric melting process is just about one-half of that formerly required with the crucible furnaces. And what is equally as important, the working conditions have been immensely

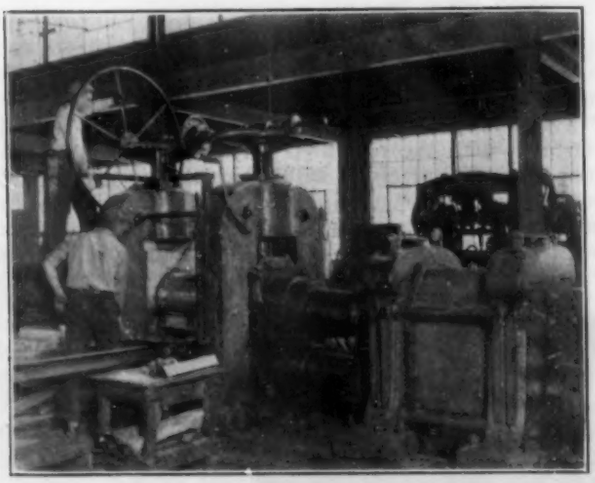


Fig. 7—Zinc Being Put Through the First, or Break-Down, Rolling Operation

improved. The furnace itself is always cool enough to touch. There is no heat or fumes to disturb efficient operation, which has also eliminated the need of a ventilating hood over the furnace.

Ordinarily the furnace is operated twenty-four hours per day—five days a week. During non-operating periods, such as week-ends, a residual charge of about 300 pounds of molten metal is left in the furnace. This is held in a liquid state by impressing 50 volts on the primary coil by means of the autotransformer mentioned above, and consumes about 4 kw. On a production run of 428,236 pounds cast, the total power consumed was 22,093 kw.h., which included the melting power as well as the holding power during non-operating periods. There are no current surges, so that the monthly maximum demand never exceeds 62 kw. which is the normal load.

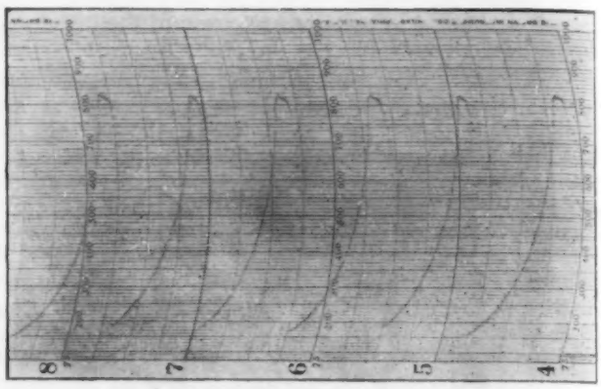


Fig. 8—Recording Temperature Chart Showing Six Successive Heats Taken from the Electric Furnace for Zinc

The electric melting process has now been in operation for a sufficiently long period to allow definite conclusions to be made. The overall melting cost is less than the former oil-fired practice, but the most important benefit derived from the electric furnace is a decidedly improved product. The rejects of finished plates today are averaging about one-third of those obtained with the fuel-fired furnaces. In short, the melting process has been placed on a strictly scientific and economical basis, compared with the old rule-of-thumb method which was largely controlled by the human element.

In conclusion, the following are the more important advantages which the Ajax-Wyatt electric furnace has shown over the fuel-fired furnaces:

(1) Improved and more uniform quality of product, due to less oxidation, prevention of burned metal, automatic stirring action and absolutely uniform pouring temperatures.
(2) Lower metal losses and spills.
(3) Lower maintenance costs.
(4) Lower labor costs.
(5) Improved working conditions—safer and more pleasant.
(6) More uniform production, due to fool-proof and more simplified operating conditions.

Pulverizing Tin

Q.—How can we pulverize tin for use in hot tinning?

A.—If you just want a fine sponge tin, melt the tin in a crucible and pour down a spout into a tank of hot water. The depth of water and speed of pouring will regulate the fineness of the sponge tin. If chloride of tin is desired, this is done by treating the tin with hot concentrated hydrochloric acid. —W. J. Reardon.

Correction

In the article "Polishing of Stainless Steels," by T. C. Eichstaedt, on page 73 of our February, 1930, issue, the second sentence of the second paragraph, "No one seems to know," etc., should have read, "No one then seemed to know what kind of polishing wheels, abrasives, glue, speed or pressure to use, or many of the other essentials for proper and economical polishing."—Ed.

The Rolling of Aluminum Structural Shapes

Equal Strength With Less Than Half the Weight

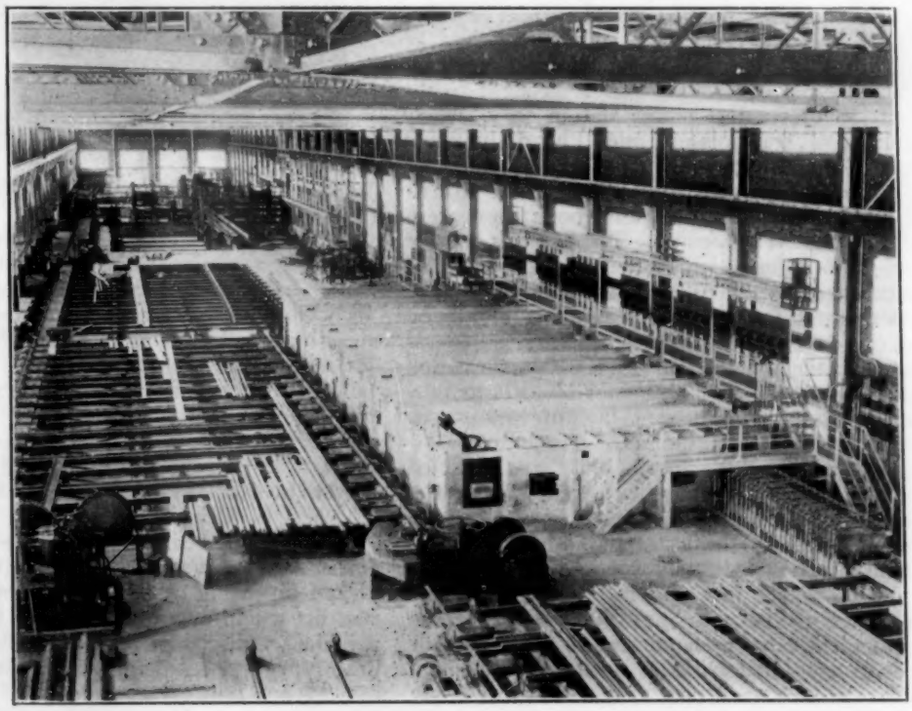
ONE of the most important of the recent developments in the aluminum industry is the installation by the United States Aluminum Company, subsidiary of the Aluminum Company of America, of a large blooming mill and structural mill at its works in Massena, N. Y. This development is in line with the modern economic trend toward the elimination of dead weight. Equipment has been installed for rolling a complete line of aluminum alloy structural sections, also large flats, squares, and rounds.

The fabricating unit used in the production of aluminum structural shapes is composed of three production centers, i. e., the melting and ingot casting unit, the blooming mill, and the structural shape rolling unit. These various production units are housed in factory buildings of the most modern design. The remelting and ingot casting unit, the blooming mill and its auxiliary equipment occupy one group of "L" shaped buildings totalling 70,000 sq. ft. of floor space. The structural mill with its auxiliary equipment occupies a single building 900 ft. long by 95 ft. wide.

The first production center is the melting department where the crude aluminum is remelted, mixed with various alloying elements and cast into various sizes and shapes of rolling ingots. The metal is remelted in large open hearth furnaces having a capacity of 20,000 lbs. of molten metal. Extreme care must be taken during the melting of aluminum; to control melting furnace temperatures there are installed very sensitive pyrometric equipment with indicating meters that give the temperatures of the metal at all times, and as a further refinement for checking they have recording instruments that record the temperature of the metal in each furnace continuously. Various sizes and types of ingots are made, depending on the material into which they are to be rolled. Ingots vary in sizes from a 12x12x72 inch ingot weighing 1,000 lbs. to a large slab type of ingot that is 15x28x72 inches weighing 3,000 lbs. These are the largest aluminum rolling ingots ever cast. Immediately adjoining the melting and ingot casting department is the first of the group of buildings occupied by the blooming mill and its auxiliary equipment. This building is used as a storage for ingots, contains the preheating furnaces and the power driven roller approach table of the blooming mill.

After preparation of the ingots they must be preheated preparatory to rolling on the blooming mill. The preheating furnace is of the pit type, a battery of 14 pits comprising the initial installation. The preheating furnace is electrically heated, the battery of 14 pits requiring 3,000 kw. Very careful control of heating must be maintained during the preheating, the temperature of the metal in the pits being controlled within an accuracy of 10 deg. F. Immediately above the preheating furnace is the gallery where is installed the most modern pyrometric and control equipment for this furnace. The temperature of each pit is taken at several points, and indicating and recording pyrometers give a continuous record of the temperature of each pit. A battery of 14 automatic temperature regulators controls the pit temperatures within any desired range. Beneath the operating platform of the furnace are located the electrical contactors that turn the power on and off each pit of the furnace, all contactors being controlled by the automatic temperature regulators in the control room.

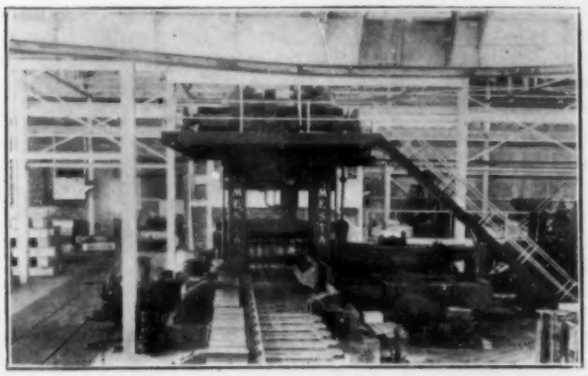
Next is the break down mill, or blooming mill, as it is commonly referred to. This mill is the largest aluminum rolling mill in the world; the rolls are 38 inch diameter by 84 inch face. The mill rolls various sizes of ingots into billet stock that will be further rolled into various structural sections. The mill is so arranged that various types of rolls can be installed. Several different shapes of rolls are used in the mill for producing various sizes of stock such as square billets, slabs, and large plate. The mill is electrically operated and the controllers are all centralized in the operating gallery in front of the mill. Two men can thus control all of the mechanical devices on the mill such as the direction and speed, the motors driving the screw down mechanism for controlling the opening of the rolls,



General View of the New Structural Mill Building at the Messena Plant of the United States Aluminum Company

the front and rear mill tables, the manipulators by means of which the ingot is guided into the rolls and turned so that the enormous pressure developed in rolling can be exerted first on one face of the metal and then on the other, thus working the metal uniformly into a homogeneous billet.

Electrical equipment is used for driving the mill and the various automatic controllers for controlling direction of rotation and speed of the mill and auxiliaries. The mill



Blooming Mill

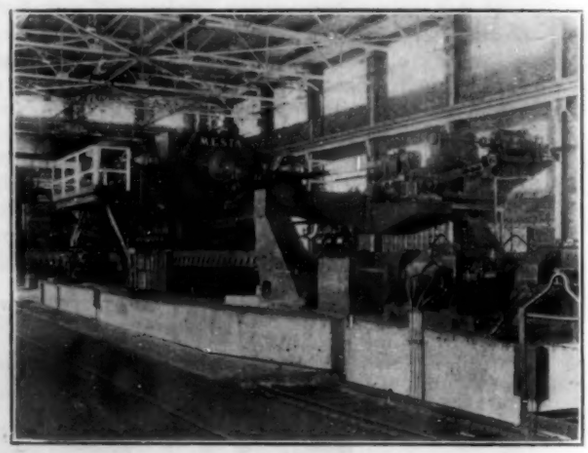
is directly connected to a 5,000 h. p. direct current variable speed reversing type motor. One has only to see the rapidity in change of direction of rotation and the rate of acceleration of this large motor to appreciate the nicety of control that can be maintained. Power for the 5,000 h. p. direct current mill motor is supplied from a motor generator set of equal capacity to the motor. The motor generator unit consists of a 6,600 volt alternating current motor directly connected to two direct current generators, these in turn supply direct current to the large mill motor. A flywheel is mounted on the motor shaft; this flywheel weighs 70,000 lbs. and is 16 ft. in diameter; the motor operates at a speed of 520 r. p. m., thus the rim of the flywheel travels at the enormous speed of 26,000 ft. per minute. The flywheel is of special construction to withstand the enormous strains set up due to the high peripheral speed. This flywheel acts as a balance between the motor and generators of the motor generator set and takes care of the enormous fluctuations in current required by the 5,000 h. p. motor driving the blooming mill.

Power for the motor generator set as well as power for the electrically heated soaking pits is brought to the motor room from the central power station on a heavy duty "all aluminum" transmission line. Large aluminum bus bar lines carry the current from the transformer located just outside of the motor room wall to the electrically heated soaking pits. In this same room are concentrated the direct current automatic control boards for the auxiliary mill motors, operation of these being controlled from the operating gallery of the blooming mill. The direct current required for the various auxiliary motors on the blooming mill is generated by means of motor generator sets located in the motor room of the structural mill and is transmitted to the blooming mill motor room by means of an overhead transmission line of heavy construction employing "all aluminum" transmission cable.

Immediately adjoining the group of buildings occupied by the blooming mill and its auxiliary equipment is the structural mill building. The structural mill is a three high mill with the exception of the last stand, which is a two high mill. In the first three stands we use rolls 26 inches in diameter by 60 inches face and in the last stand the rolls are 26 inches in diameter by 48 inches face. Rolls and guide equipment have been purchased for a number of structural sections and additional sections are planned for production in the immediate future so that a complete line of aluminum alloy structural sections will be available. Tilting and trailer tables are installed on each side of the mill, which automatically catch the stock from the pass in one stand of rolls and lift it to enter the next pass.

The structural mill is driven by means of a 2,000 h. p. 600 volt direct current variable speed motor. The direct current for this motor is obtained from a motor generator set comprising a 6,600 volt synchronous alternating current motor driving a direct current generator. The various direct current auxiliary motors of both the blooming mill and the structural mills are supplied from this station, two motor generator sets of 750 h. p. have been installed to supply current to these auxiliaries.

Let us follow through the various steps in the fabrication of an aluminum structural shape. At the blooming mill various rectangular sections are rolled from the large ingots. This stock is transported to the structural mill building by means of a narrow gauge railroad. Here the stock is first put through the billet heating furnace. This is an oil fired conveyor type of furnace. The stock is charged at one end and is carried through the furnace on an endless chain conveyor. At the discharge end of the furnace is the automatic unloader. This device lifts the billet from the furnace conveyor and places it on the power driven roller table connecting the furnace with the traveling tilting table serving the mill. The billet is quickly conveyed to the first pass in the mill. As it leaves this pass it is caught by means of the tilting table on the other side of the mill. The table then lowers and the billet enters the second pass of the mill. By means of the traveling tilting and trailer



Blooming Mill Shear

tables the billet is entered in the various passes of the mill gradually working it into the finished shape. The various stages in the rolling can be readily seen by observing the section of the piece as it is carried from pass to pass on the tilting roller tables front and back of the mill. After leaving the last stand of the mill the piece is carried on power driven roller tables to the heat treating and finishing production centers.

The heat treating furnace is the largest of its kind in the world. It is electrically heated. The heating element of the furnace is of the cast grid metallic resistor type. The length of the furnace is such that structural sections 90 feet in length can be heat treated. The stock enters the furnace on a mechanically operated carrier, it is then picked up inside of the furnace by means of lift fingers that lift it and move it across the furnace until it reaches the furnace discharge table on the opposite side. Absolute uniformity of temperature is obtained throughout the

working area of this furnace. The furnace is divided into twenty-six zones, the temperature of each zone being separately controlled by an automatic temperature regulator. Pyrometric equipment is installed to indicate and record the temperature throughout each zone of the furnace. A temperature differential of 10 deg. F. is maintained throughout the entire working area of the furnace thus insuring absolute uniformity of heating throughout every portion of the structural sections heat treated. The piece is discharged from the furnace by means of a power operated roller table, it is automatically quenched as it leaves the furnace by means of high pressure water sprays. The piece then passes to a transfer bringing it to the line of roller tables immediately adjacent to the furnace and here it is straightened. It is then conveyed by means of another transfer to a roller conveyor line where it is cut to length and its weight determined.

Certain of the high strength alloys must be tempered or aged after heat treatment and to take care of this the company has installed a steam heated aging oven. This aging oven is of such size that they can age 90 feet lengths of structural shapes. Recording thermometers have been installed permitting very close control of temperature throughout the entire heating zone. The air in the oven is circulated by means of overhead fans thus insuring rapid and uniform heating throughout every part of the load. For handling structural shapes in and out of the aging oven we use specially constructed, standard gauge, railroad type cars.

Inspection of the product is made throughout its entire fabrication. Exact technical control of every process is maintained by a staff of metallurgists. Modern laboratory equipment is available for chemical and physical tests, and for microscopic examination. At final inspection, in addition to the usual examination for accuracy of dimensions and surface defects, tests are made in our laboratories insuring that the product meets our exacting physical and chemical specifications.

There is erected in the structural mill a 10-ton overhead traveling crane built of high strength aluminum alloys. Load tests made on this crane show that it compares favorably in strength and rigidity with a similar crane fabricated from steel but with a saving in weight of 24,000 lbs.

Polishing Aluminum Castings

Q.—We are going to have a lot of aluminum castings which require grinding and buffing up after grinding. A few we have had ground on a 120 emery, as a roughing cut, and then greased on a flour grease wheel made of sewed buffs. In buffing, marks of emery appear hard to remove. Can you tell me the reason why and how you would treat same?

Again, I will want to make a number of abrasive wheels, from two to five sections. Would you inform me as to the proper way to glue them together, true them up before applying different grades of emery, how to level them straight as we have some that are ridged in center and round cornered; also, how you would remove the old abrasive from them entirely. Do you think tallow would be better to use than paste?

A.—In removing the emery marks from the rough cut on your aluminum castings the first thing is to reduce the coarseness of the cut. We suggest that your first cut be on a 120 grade wheel, using a very little grease to reduce depth of cut; follow with a number 180 or 190 grease cut and fine on your flour grease wheel. Then buff as usual with an open buff. We believe this will clear your trouble. Lubricate with tallow or lard oil in preference to paste.

To build cloth polishing wheels up to any number of sections, proceed as follows:

Take sections of buff and balance on mandrel in order to get them to run as true as possible before gluing. Make a mark across face of wheel, marking every section at the balancing point, in order that when the wheel is separated for gluing, it can be reassembled to line up with the same balancing point.

Have an iron bench plate about 18 inches square. Lay one section on plate and coat top side with plenty of glue. While glue is still hot on the cloth, take the second section and lay on top of first, centering the hole on the upright mandrel and lining balancing marks on both sections. Follow through with as many sections as desired, making sure that sections adhere together by tapping them together with a mallet as each one is glued on.

While glue is still damp, take out mandrel and put on weight up to 125 lbs. to keep them from separating. Leave at room temperature to dry for 48 hours or more.

Put wheel back on mandrel and balance on balancing frame by screwing a piece of lead on the side of the wheel about four inches from the mandrel in the part of the wheel which tends to keep at the top while being balanced. Next, place wheel on arbor in speed lathe, and dress down the face of the wheel until all high spots are removed, leaving a nice clean nap on the face of the wheel. Then size face of the wheel with a thin coat of glue to lay down the loose threads and close the face. Let this dry at room temperature for 3 to 6 hours.

The wheel is now ready for the coat of emery; apply the second coat of glue—heavy—and roll in emery. Dry from 4 to 6 hours. Give third coat of glue and the second coat of emery. If wheels are to be used on flat work or where edge of wheel will not be worn or broken, as many coats may be put on as desired, drying after each coat.

Before placing a set up wheel on the polishing bead, tap the face of the wheel lightly in order to slightly fracture the glue bond. This gives a softer face and reduces the coarseness of the cut.

Old abrasives may be removed with a segment of emery wheel or by one of the carburundum tools on the market. Or, a tool may be made by taking a 12-inch length of 1½ inch gas or steam pipe and grinding teeth around the end. A little care in learning how to handle the tool will prevent loss in wheels. Always start at one side of the wheel and cut across, instead of attacking the face.

—Walter Fraine.

Die Cast Duralumin

In our February issue on page 69 under the heading "Die Cast Duralumin," a question was asked as to the feasibility of using Duralumin die castings for phonograph reproducers. The answer explained the difficulties in the use of Duralumin for die castings, due to the fact that heat treatment is required to bring out the properties of Duralumin and that such heat treatment would develop blisters in pressure die castings.

Inadvertently, in transmitting this inquiry to the expert who answered it, Mr. Tour, the fact was omitted that this part was to be used as a phonograph reproducer.

Under these circumstances, the following paragraph would have been added to his answer if he had been informed of the question in full.

"Any aluminum base alloy which is now used in the pressure die casting industry, is perfectly satisfactory for phonograph reproducer parts and heat treated duralumin alloys would hardly be necessary."

Throwing Power in Chromium Plating

A Summary of a Report on the Research at the Bureau of Standards

By H. L. FARBER

Research Associate, American Electroplaters' Society

FROM THE MONTHLY REVIEW OF THE AMERICAN ELECTROPLATERS' SOCIETY, NOVEMBER, 1929. DETAILS OF THIS INVESTIGATION WILL BE PUBLISHED IN THE NEAR FUTURE AS A RESEARCH PAPER OF THE BUREAU OF STANDARDS.

I—Introduction

ALTHOUGH numerous authors have compared the throwing powers of different chromium plating solutions, as measured for example, with bent cathodes, no numerical data on throwing power have been previously published. The definition and methods used in this study are those described in previous papers from the Bureau of Standards.

II—Principles

(a) Throwing Power:

The throwing power is defined as the improvement in per cent, of the metal distribution ratio above the primary current ratio. If the latter is 2:1, and the metal ratio is 1.5:1, the throwing power is +25 per cent. If however the metal ratio is 3:1, the throwing power is —50 per cent. In chromium plating the throwing power is always negative. A value of —25 per cent is good, while one of —100 per cent is poor.

It has been shown that in all solutions, the throwing power depends only on the cathode polarization, the conductivity and the cathode efficiency. In chromium plating the cathode polarization and conductivity have negligible effects. Hence the throwing power depends almost entirely on the relation of the cathode efficiencies at the high and low current densities used. If these cathode efficiencies were equal, the throwing power would be zero. Actually the cathode efficiency in chromic acid baths is always less at low than at high current densities. This causes negative throwing power. Thus, if the cathode efficiencies are 16 per cent and 8 per cent at the high and low current densities respectively, the throwing power is —100 per cent. The only way in which the throwing power can be improved is by making these cathode efficiencies more nearly equal.

(b) Methods of Improving the Primary Ratio:

As, at best, the throwing power in chromium plating is poor, it is desirable to so arrange the cathode and anodes as to have the current density on the cathodes as nearly uniform as possible. This can be accomplished in the following ways:

(1) Have the anodes and cathodes parallel or concentric.

(2) Have the cathodes a considerable distance from the anodes.

(3) Have conducting wires or rods connected to the cathodes so as to detract or "steal" the current from points that tend to get too high a current density.

(4) Use insulating shields to deflect the current from projecting parts of the cathodes.

(c) Plating Range:

In chromium plating it is especially desirable to obtain bright deposits all over the cathode, as it is usually difficult to polish dull chromium. For each solution there is a limited range within which bright deposits can be obtained. The selection of this plating range is often more important than the actual thickness of the deposits, as expressed by the throwing power.

(d) Covering Power:

The bent cathode test measures the extent to which the cathode is covered. As will be seen the results are practically parallel to the throwing power.

III—Methods of Study

The throwing power measurements were made in a glass-lined steel box. A platinum gauze anode was used, and polished steel cathodes were used in most of the tests. The primary ratio was 2:1. The cathode efficiencies were calculated from the currents used and the weights of deposits. The latter were classified as (M), milky, (Br) bright, (F) frosty, and (Bu) burnt, in order to define the plating ranges. The bent cathode tests were made in the same glass box, and the ratio of distances from the anode to the far and near parts of the cathode was also 2:1.

IV—Results Obtained

The data obtained in several hundred experiments will require numerous tables and curves for their complete presentation. In the following table a few typical results have been assembled in order to show the principal effects of the different conditions.

V—Conclusions

From these experiments the following conclusions were drawn:

1. The throwing power is determined almost entirely by the cathode efficiencies, and can be improved by making these efficiencies more nearly equal at the maximum and minimum current densities used.
2. At a given current density an increase in temperature reduces the throwing power.
3. At a given temperature, an increase in current density improves the throwing power.
4. Good throwing power and bright deposits can be obtained more readily at high temperatures and current densities than at low. A higher voltage is required however.
5. Dilute solutions of chromic acid give better throwing power for a given current density. As however their resistance is greater, a higher voltage is needed. For a given voltage (e.g., 5 volts at the tank), better throwing power is obtained in the more concentrated solution.
6. A low content of sulphate, e.g., $CrO_3/SO_4 = 200$ gives slightly better throwing power than a ratio of 100, and much better than a ratio of 50.
7. Sodium dichromate, added in large amounts to a solution with a sulphate ratio of 100, slightly improves the throwing power, probably by changing the sulphate ratio. If the latter is 200, the addition of sodium dichromate is detrimental.

8. Boric acid has no appreciable effect on the throwing power.

9. Small concentrations of trivalent chromium have no effect on throwing power. High concentrations increase the throwing power, making it equal to that of a more dilute solution. As the resistance of the bath is thereby increased and the plating range decreased, trivalent chromium is not advantageous.

10. Iron has practically the same effects on throwing power as trivalent chromium, but a greater detrimental effect on the resistivity and plating range.

11. Polished metal surfaces yield better throwing power than rough surfaces.

12. The throwing power is slightly better on steel and brass than on copper and nickel.

13. The results for covering power on bent cathodes are practically parallel to the measured throwing powers.

14. The best throwing power (—13 per cent) with bright deposits, was obtained in a solution containing 250 g/L (33 oz/gal) of CrO_3, 1.25 g/L (0.17 oz/gal) of SO_4 at a temperature of 55°C (131°F) and an average current density of 35 A/dm² (325 A/ft²). This required in the box, 6.4 volts. Such conditions are suggested for use when a voltage above 6 is available, and when the best attainable throwing power is desired.

15. When the voltage is limited, and, e. g., only 5 volts is available at the tank, a good throwing power (about —30 per cent) can be obtained with 400 g/L (53 oz/gal) of CrO_3 and 2/g/L (0.27 oz/gal) of SO_4 at a temperature of 45°C (113°F) and an average current density of 15 A/dm² (140 A/ft²).

16. In the latter solution, at a temperature of 35°C (95°F) and an average current density of 7.5 A/dm² (70 A/ft²) a throwing power of about —60 per cent is obtained. This is usually satisfactory if the articles are not of very irregular shape, or are favorably placed in the tank.

Typical Throwing Power Data

I—EFFECT OF TEMPERATURE AND CURRENT DENSITY

250 g/L (33 oz/gal) CrO_3; CrO_3/SO_4=100

°C Temp	°F	A/dm² Av. C. D.	A/ft²	Volts	Power % Throwing	Appearance Near	Far
25	77	5	47	3.9	—295	Bu	M
35	95	7.5	70	3.9	—108	F	M
35	95	15	140	4.8	— 58	F	Br
45	113	15	140	4.6	— 65	Br	Br
45	113	25	230	5.8	— 27	F	Br
55	131	25	230	5.5	— 46	Br	M
55	131	35	325	6.4	— 28	Br	Br
55	131	45	420	7.5	— 14	Br	Br

II—CONCENTRATION OF CrO_3

45°C (113°F); 15 A/dm² (140 A/ft²)

Conc. g/L	CrO_3 oz/gal	CrO_3/SO_4	Volts	Throwing Power %	Appearance Near	Far
150	20	100	5.2	—50	Br	Br
250	33	100	4.6	—65	Br	Br
400	53	100	4.5	—85	Br	Br

III—CONCENTRATION OF SO_4

45°C (113°F); 15 A/dm² (140 A/ft²). 250 g/L (33 oz/gal) CrO_3

50	4.7	—154	Br	M
100	4.6	— 65	Br	Br
200	4.7	— 52	Br	Br

IV—TRIVALENT CHROMIUM AND IRON

45°C (113°F); 15 A/dm² (140 A/ft²)

250 g/L (33 oz/gal) CrO_3; CrO_3/SO_4=100

Cr^{III} g/L	oz/gal	Fe^{III} g/L	oz/gal	Volts	Throwing Power %	Appearance Near	Far
0	0	0	0	4.6	— 65	Br	Br
3	0.4	..	..	4.6	— 64	Br	Br
9	1.2	..	..	4.8	— 57	Br	Br
17	2.3	..	..	5.5	— 43	Br	Br
34	4.5	..	..	7.0	— 29	Br	Br
..	..	4	0.5	4.6	— 71	Br	Br
..	..	9	1.2	4.7	— 56	Br	Br
..	..	19	2.5	5.1	— 55	Br	Br
..	..	37	5.0	7.8	— 37	F	Br
9	1.2	9	1.2	5.5	— 58	Br	Br
1.3	.2	0.9	.12	4.6	— 71	Br	Br

Etching Steam Gauge Dials

Q.—Could you give us information on how to etch steam gauge dials, silver, with black lettering, the chemicals to use and the resist ink?

Have you any information on how to etch steel, such as B. & S. scales used by carpenters, machinists, etc.?

A.—There are two methods of etching dials commercially. One is the photographic method, as follows:

Photographic Process

1. Make a photographic negative of the design wanted.
2. Take the brass plates, polish if bright figures are required, and plate in a black nickel solution to get the black figures.
3. Sensitize the plates with:

Sodium ammonium carbonate ..	15 grains
Photographers engraving glue .	4 drops
Ammonia (commercial)	8 drops
Water	8 ozs.

4. Photograph plates. Four minutes at light distance of 3 feet, using 20,000 candlepower.
5. Etch in following solution:

Either nitric acid or perchloride iron..	1 part
Water	10 parts

6. Wash resist from etched portions and strike in silver solution to get white background.
7. Remove resist from figures with benzol.

Rubber Stamp Method

The second method is to make a rubber stamp covering the surface of the plates with the figures cut in relief. Cover surface of figures on the stamp with resist ink and apply to surface of plate. This will print the figures. Etch as outlined in preceding process. Silver plate background, remove resist ink from surface of figures either with benzol or caustic solution, and blacken figures in the following solution: aqua ammonia, 26°, carbonate copper to saturate, Nitrate of copper, 1/10th amount of carbonate used. Rinse, dry and lacquer.

Etching Scales

Without knowing the exact method used for B. & S. scales, we believe the photographic etching method given above would be needed to duplicate the exactness required in the measurement and line work involved. The resist ink may be made as follows:

Heat and mix thoroughly 40 parts of pitch or asphaltum, 28 of rectified tar oil, 8 of aniline-violet sebate, 24 of residue of the distillation of black rosin oil.

Manufacturers of ink will be glad to work with you to produce the best for your purpose.

—WALTER FRAINE.

Analysis Vs. Guesswork

Why Do We Analyze Nickel Solutions?

By THEODORE ROSS
General Manager, Chromium Service and Sales, Inc., Long Island City, N. Y.

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

THE period of guesswork and rule of thumb methods is definitely past in the plating industry High standard of workmanship and intensive economy in production costs compel manufacturers and platers to use more rigid control of plating solutions, which is possible only through chemical analysis.

In the case of nickel-plating solutions, all the ingredients that go to make up the original solution change more or less, according to the amount of work put through. After a month or two, if corrections are not made from time to time, the nickel solution will be quite different from what it was when first made up. The amount of change cannot be predicted, it cannot be determined by looking at it, or by using a hydrometer. A chemical analysis is the only logical way to find out what is in the nickel solution (or more correctly, what is left in the solution) after, say, a week's operation.

Types of nickel solutions are numerous, and formulas for different purposes are countless, but the essential parts of practically all solutions are no more than the following four:

Nickel.
Chlorine.
Alkalinity (in the form of ammonia or nickel hydrate).
Boric Acid.

The quality of plating from a certain nickel solution will be kept up as long as these four factors are maintained at a definite standard. To maintain them, however, one must know, first, the amount of each material that is supposed to be in the solution and then check it by chemical analysis at regular intervals to see that the required amount is not changed, or else correction must be made as outlined below.

Nickel Content. A nickel solution made up according to any reliable formula will give good results. By working, it usually loses its nickel content due to many reasons, such as drag-out, impure anodes, and poor anode corrosion. A solution may also lose a large amount of its nickel content overnight during cold weather, due to crystallization. Nickel salts, once they crystallize and fall into the bottom of the tank, do not redissolve readily. When nickel content of a solution falls below a certain point, bad results will occur, such as streaky deposit, poor throwing power, and low cathode current efficiency.

But, if the nickel content becomes too high, as, for instance, due to a mistake in making an addition, the work may come out burnt. Although there is a certain range in which nickel content may vary without detriment to the results, a close regulation at the specified level is desirable, and a chemical analysis is the only sure way to test the exact amount of nickel in solution.

Chlorine Content. In the old days, when nickel anodes ran from 93 to 95 per cent pure, the chlorine content of the nickel plating solution was not an important factor. But then, the impurities from anodes constantly fouled the solution giving rise to rough deposits and pinholes. So, today, platers use pure nickel anodes. But the trouble with the pure nickel anode is that it does not dissolve as readily as the impure one. The result often has been that the solution gets less nickel from the anode than it gives out on the work and it becomes depleted. Chlorine, as chloride in the nickel solution, helps the nickel anodes to disolve and in that way restores the nickel content that has been depleted through plating, but the moment the chlorine content falls below normal, the anodes refuse to dissolve in the solution at the same rate as nickel is deposited on the work. Sometimes they do not dissolve at all. The result is that the nickel content gets lower and lower and nickel salts have to be added to restore the normal condition of the solution. If not, the troubles inherent with low nickel content will surely come up. This is the reason why chlorine in a nickel solution must be properly controlled by chemical analysis so that labor and expense for nickel salt additions may be saved.

The minimum amount of chlorine required for good anode corrosion is one ounce per gallon, or 7.5 grams per litre. It may go as high as 2½ ounces per gallon, in the case of double salt solutions, without detrimental effects on the nickel deposit. Of course, to have anything much exceeding the required amount is wasteful and has no justification in commercial work. Here the chemical analysis comes in and prevents both troubles and waste of materials. Chlorine content should be determined at least once a week to insure normal working of the nickel bath.

Alkalinity. By alkalinity we mean the alkalinity of nickel solution with respect to a certain indicator. Color, ductility, hardness and tendency to peel depend largely upon the hydrogen-ion concentration of the nickel solution. To determine the hydrogen-ion concentration accurately requires elaborate apparatus and delicate manipulation, but if we titrate the alkalinity of the solution with respect to a certain indicator we get a value, i.e., in terms of number of cc. of ammonia per gallon or its equivalent, which is a measure of the hydrogen-ion concentration, provided the composition of the solution is not altered. For any two nickel solutions, even if the alkalinity may be the same, the hydrogen-ion concentration may be quite different. But, when we deal with any particular tank and get the same alkalinity from day to day, we may be sure that the hydrogen-ion concentration in that tank will also be the same from day to day.

Boric Acid. Boric acid is an important ingredient in nickel solutions worked in still tanks. It helps to stabilize the hydrogen-ion concentration and maintain a clean anode surface. But the workable range of boric acid content is wide and small variations do not affect good results in plating. An adjustment of boric acid content once a month or once in two months will be sufficient for effective control.

The time spent in making analysis of nickel solutions is always a profitable investment, for it is the only way to maintain a high quality of product and to insure uniform results at all times.

With chromium plating becoming more and more popular, rigid control of nickel solutions is imperative so that the nickel deposit will not peel under the strain of the chromium.

Production Methods Used in Cadmium Plating

A Description of the Mechanical Operations Involved in Quantity Work

By OTTO H. LOVEN
Electro-Chemist, Bridgeport, Conn.

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

PLATING is essentially an art to beautify and protect objects used in our every-day life. In some cases, the appearance is of major importance, in others the protection, and in still other cases, both share equally. In the first and last instances, cadmium plating does not play a big role, but where the protective feature is uppermost, cadmium gives the best results.

A multitude of parts, such as screws, bolts, nuts, stay-rods and the like can now be obtained in most hardware stores, cadmium plated. The low cost of the articles themselves prohibit a costly method of plating, and in this respect cadmium plating is most suitable, as a very heavy and pleasing plate can be obtained in barrel plating, which will give lasting satisfaction. It is only through quantity production that a low price of 2 to 3c. per lb. can be quoted on well-covered objects. It is therefore, of interest to follow the progress of the work through a plant which has been designed for the purpose.

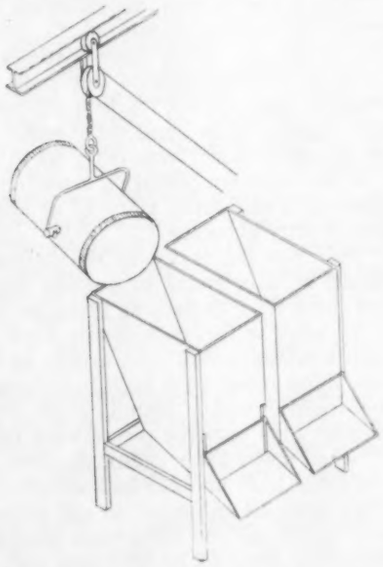


Fig. 1—An Efficient Type of Loading Unit for Placing Work in Containers for Washing

The scope of this paper takes into consideration only the actual washing, plating, rinsing and drying operations. We assume that other operations necessary for obtaining the desired finish, such as rolling or tumbling, and polishing and buffing have been completed. The first operation will then be to place the work into the containers used for washing the work. Depending on the quantity of work to be handled, this may be done by hand, or semi-automatically. Manual operation is preferable only, where there are a multitude of small lots to be handled, each of which is equal to one or two loads in the wash unit. Semi-automatic loading saves a lot of time and labor where large lots are handled, the plating of which may be carried on continuously. The loading may be accomplished in several ways, of course, but we have here availed ourselves of one type of unit, which is comparatively inexpensive, and at the same time handles a variety of work quickly and efficiently.

The unit (see Fig. 1) consists of a number of hoppers, so arranged, that the work is lifted up by means of a hoist, and dumped in from the rear, and with sliding doors in front, through which the work is fed to the wash container. The number of hoppers necessary is governed by the number of products going through at the same time, and the number of plating barrels in the unit. Several kinds of work are handled successively in each hopper.

Next, we come to the container in which the work is to be washed. Here again, we have the choice of a variety of ways, in which to accomplish that operation. One way is to use baskets, made of steel screen, and suspend them from a moving rod in the wash solution. I dare say that this is one of the most common washing arrangements, does the operation fairly fast and, unless the work packs tightly, cleans as well as any other type of washer. The limitations of this arrangement do not make it very suitable for production purposes, however, and therefore, an arrangement, which permits giving the work a more thorough cleaning is used. Fig. 2 shows a barrel, constructed of perforated steel sheeting, with a trap door, for filling the barrel with work, to be washed. It is then picked up with the hoist, and carried over to the wash tank. The wash tank, usually made of sheet steel, is fitted with bearings to receive the shafts at each end of the barrel, and a chain driving arrangement on the back of the tank, which drives the barrels, through a sprocket, fitted to the end of the barrel shaft. The advantage of the barrel, for the washing of the work lies in the rotating motion, which will effectively remove all loose matter from the work, and at the same give it a slight polish.

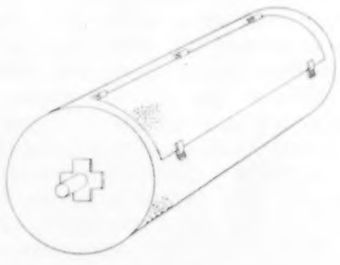


Fig. 2—The Perforated Steel Barrel for Washing Work

To clean the work, the common potash solution is employed. The average time for thorough cleaning varies with the class of work, but even in the most stubborn cases, 10 to 15 minutes will be sufficient. In line with the potash tank, and also fitted with a driving chain, are a number of rinse tanks containing in turn, running cold water, hydrochloric acid solution 10 per cent strength, running cold water, sodium cyanide, 4 oz. gal., and two running cold waters. The overflow from the last water tank is piped back to the third water tank, which in its

turn is supplying the second and first tank. In this manner the water is thoroughly utilized, without lessening the effect of the rinse. As the time in each one of the last mentioned rinses is one minute or so, it is obvisous they do not have to be of the same capacity as the potash tank.

The size of the potash tank is calculated from the number of barrel loads to be cleaned, each 10 or 15 minutes. Supposing that the requirements are 9 plating barrel loads per hour. The same number of loads, have to be cleaned in the wash barrels, or say, 3 every 20 minutes. The potash tank should then be large enough to take at least 3 barrels at a time, which allows a fair margin for expansion, if later, one should wish to increase the capacity. Each of the following tanks will then need to handle only one barrel at a time. Maximum output from this unit will then be approximately 12 loads per hour with one man washing, or 18 loads with two men.

When the work has passed through these operations, it is ready to be plated. After the wash barrel has been hoisted out of the last rinse, and allowed to drain for a moment, it is brought over to the tank. The plating barrel to be loaded is of same dimensions and appearance as the wash barrel, but made of wood or other suitable material; uses the same method of driving and is suspended on bearings, as was the wash barrel, in a rinse tank, alongside the plating tank. A hopper, or trough, is used to transfer the work from the wash barrel to the plating barrel. The empty wash barrel is sent back to the loading point, and the plating barrel is carried on to the plating tank.

We shall now leave this barrel and follow another, which is ready to be taken out of the plating solution. This barrel is brought out to the beforementioned rinse tank, where the other one was loaded, the cover removed, and the barrel rotated, to let all the contents drop out. Under the barrel is a trough, or sieve, set on supports in the rinse tank which receives the work. The reason for using this method of emptying and rinsing is to prevent the work from staining, which will happen if the work is left in the air even for a few minutes before the solution is washed off. (It may be well to remark at this point that any attempt to save this rinse water and use it to replenish the plating solution, defeats the purpose. Clean running water must be used at all times.) After the barrel has been reloaded, the sieves are lifted out and sent through a combined rinse and drying machine, and when through, the contents are dumped into a sawdust dryer and the sieves returned to the rinse tanks.

A few words concerning the after-rinse. This machine consists of a series of three tanks, and a drain space. Above and on the sides are splash shields and inside these are a number of shower heads, spraying first cold, and then hot water on the work. A similar arrangement is used to spray from under, to give a thorough wash. A set of wooden rollers, driven from the outside, through so-called greaseless bearings made of a special hardwood, are used to propel the work forward. In the last section, the work is given a chance to drain off, aided by a gentle stream of warm air, at a temperature of 110 to 125°. If a higher temperature is used, the work will not be shiny, but take on a gray, dull color. As the sieves with the work come out from the drain, they slide along to the apron, in front of the sawdust dryer, where they are emptied, and the work alone goes through and is received at the other end in a suitable container. A plating unit of almost identical makeup as the one here described has, for the past two years, consistently turned out an average of 2,000 to 2,500 lbs. per hour, running at least 50 hours per week, and in the busy season as high as 120 hours per week. The details of plating time, composition of solution, etc., have been covered in previous articles in THE METAL INDUSTRY (June, 1928-May, 1929) and will therefore, not be repeated here.

The essential operations of cadmium plating have now been described, and the product at this stage is ready for delivery to the assembly, or shipping department, as the case may be. In some cases, however, where the product is prominently displayed, there may be a desire to maintain the original brightness of the plate for a longer period of time. This may be accomplished by giving the work a dip in invisible lacquer, and drying it in warm air. It is of great importance to have a perfectly clean surface, free from any cyanide, before lacquering, as otherwise there will be spotting out under the lacquer. To insure this thoroughly clean surface it will be necessary to add a couple of operations in the after rinse; after the hot water rinse, a rinse of 10 per cent acetic acid, to effectively neutralize the cyanide; then a warm water rinse; then through the warm air drain space. Instead of the sawdust dryer the work is then quickly emptied into wire baskets, and dipped in a waterdip lacquer, whirled dry in a centrifugal dryer, and then spread on screens, and dried in an oven for 5 minutes at a temperature of 140° F.

Comparative Value of Cadmium as a Protection Against Corrosion

Before the advent of cadmium as a commonly used protection against corrosion, the plater was forced to use at least two and often three coatings of different metals to obtain a durable finish. The most commonly used combination was: nickel, ½ hr.; copper, 1 to 1½ hr.; color buff; nickel ½ hr., and color buff. At its best, the value in salt spray hours was from 50 to 75 hours.

With cadmium plated on a well prepared surface for 45 minutes, a salt spray value of at least 150 hours has been consistently obtained.

This has led many to the assumption, that cadmium would be a splendid subcoating for use with a brighter and harder finish such as nickel or chromium, But more is the pity, so far, nobody has made a real success of any such a combination. An article of spring tempered steel was shine rolled to a high luster, cadmium plated, rinsed thoroughly, nickel plated, color buffed, and chromium plated. One hundred pieces were taken for test, of which 25 were taken after cadmium plate, 25 after nickel plate and color buff, and the balance after the completed finish. They were all subjected to salt spray test simultaneously, and the nickel and chromium plated parts started breaking down after 55 to 60 hours test, while the parts with only cadmium plate lasted over 150 hours. In another test, brass plate was used after cadmium, and then nickel-plated. The result was similar. Another drawback in using cadmium as a sub-coating is the fact that the finish will show a tracery, like a cobweb, which mars the appearance of the finish, where a high luster is required.

The value of corrosion resistance in the open air, seems to be even more favorable for cadmium, as applied alone, against other combined coatings, because of the negative value of cadmium in the electromotive series. In several cases, where cadmium has shown twice the resistance to salt spray test, as compared with other coatings, the open air exposure has shown a value of at least three times that of others, under the same conditions. On account of the great variation of conditions, as to location and humidity of the air, an estimate of its life is misleading, unless these conditions are known. Conservatively speaking, a cadmium coating, testing 150 hours in the salt spray, should give at least two years of perfect service even in the most trying conditions, such as obtain along the seaboard, where the air is permeated with salt mist from the ocean, and the humidity is at all times much higher than inland. In a dry climate it will in most cases outlast the life of the article on which it is applied.

New York Platers' Meeting

THE New York Branch of the American Electroplaters' Society held its annual banquet and educational session on February 15, 1930, at the Aldine Club. The educational session started at 3:30 P.M. with Franklyn J. MacStoker chairman of the Banquet Committee in charge. He made a brief speech and turned over the meeting to Fred Haushalter, president of the Branch, who made an address of welcome to the members and guests. He then turned over the reins of the meeting to Charles H. Proctor, founder of the Society, who continued to act as chairman of the session.

Mr. Proctor in his address made a plea for more intensive study of the control of hydrogen in nickel and copper solutions, stating that by controlling this factor, the operations of such solutions would be stabilized.

The next speaker was Dr. L. C. Pan, instructor of electroplating at the College of the City of New York. Dr. Pan spoke on the determination of throwing power in electroplating solutions. He covered the whole question of throwing power exhaustively, giving the factors in various solutions that were favorable and unfavorable to throwing power; describing methods of calculating throwing power and methods of testing the throwing power of different solutions. He described, in conclusion, a new method of testing solutions for throwing power, developed by himself. He showed a "Cavity Scale" which consisted of a bar of metal, brass, copper or steel, with a series of holes of the same diameter and increasing depth. These holes were given numbers ranging from 10 to 100 depending upon the ratio of the depth to the diameter of the hole. When this bar was placed in the solution, the shallow holes were coated over and the plating thrown in the deeper holes up to the limit of its throwing power, which was measured by the designation of the deepest hole plated.

In the discussion, Mr. Proctor described an experience of his own in which he greatly increased the throwing power of a cyanide copper solution by adding one ounce of potassium hydrate (caustic potash) per gallon of solution.

The next paper was by F. J. MacStoker and Harry Levine entitled "A Story of Bronze Plating: A Procedure Somewhat Different." Mr. MacStoker read the paper which described unusual methods of bronze plating and finishing lighting fixtures, getting various shades by the use of cadmium in the solutions, in varying amounts. It was stated that the methods had been worked out in cooperation with Dr. Pan.

The last paper on the program was to have been read by George B. Hogaboom, electro-chemical engineer for the Hanson-Van Winkle-Munning Company and associate editor of THE METAL INDUSTRY. Mr. Hogaboom, unfortunately, had been taken ill in Detroit, and was consequently unable to be present. A telegram of sympathy from the meeting was sent to him with the best wishes of the entire gathering.

Mr. Proctor then called upon various members and visitors to speak to the meeting. Horace Smith, president of the Supreme Society invited all to the meetings of the Bridgeport, Rochester and the Newark Branches. He also made a plea for the united support of the Research Program.

George Gehling, secretary-treasurer of the Supreme Society, commented on the fact that it had entered its twenty-first year, thus "coming of age." He pointed out that this meant the beginning of a period of hard work rather than the end. As he put it, the Society was now ready to do a "man's job." He pointed out one "man's job" ahead of the plating industry, namely, competition with or the utilization in some fashion, of the new stainless iron which many were claiming might eliminate chromium plating. It was Mr. Gehling's opinion, and the consensus of the meeting in general, that chromium plating would not die, regardless of new alloys, and that electroplating would not only meet the competition of these alloys, but it would also make use of them.

J. Stremel read a copy of a paper which he had read at the meeting twenty years before, an "Appeal for Harmony." This paper illustrated clearly the long strides forward made by the Society.

F. C. Mesle spoke on the changed conditions in the business world and the need for men who could adapt themselves to changes, keeping abreast of the times.

C. J. Wernlund described a new laboratory plating barrel, consisting of a squirrel cage rotor with soft-rubber-covered bars. This barrel allowed as much as 50 per cent openings between the bars, thus speeding up the plating. Mr. Wernlund also recommended the development of standards for plated finishes, in order to protect the industry against low grade work.

After the educational session, the banquet was held, attended by over 500 members and guests. Souvenirs were distributed by the Egyptian Lacquer Manufacturing Company. A number of attractive prizes were awarded by the Branch and each lady received a beautiful brooch. It was a gay party and dance, as all New York affairs have always been.

International Fellowship Club

The International Fellowship Club held a Luncheon at 1:00 P.M., at the Aldine Club just before the educational session of the New York Branch. A total of over 30 attended.

W. B. Price, chief metallurgist of the Scovill Manufacturing Company, of Waterbury, Conn., gave a very interesting talk illustrated with lantern slides, describing the work of the technical department of the Scovill Manufacturing Company, how it helps the sales divisions, and the beneficial effect of the cooperation between the technical and sales departments for both buyers and sellers.

Recovering Silver

Q.—I wish to get some information regarding scrapings of backs of old mirrors. Can these be used over again in our silver solution? We do a large mirror business as well as all kinds of plating. We remove all paint first, also shellac; then dissolve silver on glass with acid and gather same into a bowl. This we have been saving and before trying any way, thought we would get your advice on which would be the best way. Can we throw this down to a chloride and use again as silver chloride in the solution?

A.—The success of silvering mirrors is dependent upon the purity of the chemicals used. It is necessary to use nitrate of silver. You would have considerable work to convert silver chloride into a c.p. silver nitrate. It would be far more economical to send your residues to a refiner.—ELECTROCHEMICAL ENGINEER.

Spots on Galvanized Ware

Q.—For several days we have been experimenting with the use of pure zinc chloride for a wash before galvanizing, our object to completely eliminate the use of muriatic acid, using 33% pure zinc chloride, granulated form, to 67% pure water.

At first we kept this heated by steam coils to a temperature of 120 to 130 degeres Fahrenheit, but found that the heat killed the solution. Removing the steam coils, we ran the solution cold, washing the ware as it came from the 2% sulphuric pickle first in cold water, then in hot water, then in zinc chloride solution; then to the flux on the galvanizing kettle. This flux is made of pure coarse grey sal ammoniac, using a pinch of sawdust to thicken it. Nothing else is used; no glycerine whatever.

After removing the article from the metal bath, we find many with black spots; also, white spots, not properly coated with spelter. High grade Prime Western spelter is used. Temperature of metal, 870 to 880 degrees, controlled by potentiometer recording system. Aluminum used for brightening, about ½ to ¾ lbs. per day, depending upon the amount of ware galvanized. Aluminum is mixed with spelter in small bar form and thus added to the bath.

We are at loss to account for the spots. Of course, adding fresh chloride to the wash helps to partly stop this trouble, but such procedure is too costly.

In the manufacture of black ware, where various oils are used, such as machine oil, soluble oil, cutting compounds, which are not completely removed in the sulphuric pickle, as you know, would this have the effect of killing the chloride bath or what can it be that contaminates this bath? We have also tried adding 25 to 50 lbs. chloride daily, with not much better results.

A.—Every galvanizing plant has its problems. In galvanizing black ware, to get the best results, it is necessary to remove all oils and greases from the surface by running through a hot caustic solution:—6 ozs. caustic soda per gallon of water; before pickling. Otherwise, the pickler used will not remove the grease or the scale underlying the grease, and defective work results.

The use of zinc chloride in place of muriatic acid is quite satisfactory, but we question the value of it from a cost standpoint as muriatic acid is much cheaper and the life of the solution is longer. Its greatest objection is fumes given off, and that can be taken care of by a suitable exhaust hood.

It is possible that the oxides on the surface of the galvanizing kettle cause the black spots by adhering to the metal surface when drawn through the flux. Investigate.

—Walter Fraine.

Black Dip for Brass Plate

Q.—Would like to know of a black dip for brass plated hardware. Must be soft black for relieving on a scratch-brush wheel for antique brass. Tried quite a few formulæ but the black was always too hard to relieve with wheel.

A.—Either of the following solutions should give the results desired:

Plating Solution

Double nickel salts	7 ozs.
Sulphate of copper	2 ozs.
Chloride of sodium	6 ozs.
Aqua ammonia, 26%	4 ozs.
Water	1 gal.

Use cold, with nickel anodes, at not over 2 volts.

Immersion Solution

Aqua ammonia	1 gal.	
Carbonate of copper	1½ lbs.	Use
Nitrate of copper	10 ozs.	cold
Water	1 gal.	

Immersion Solution

Acetate of lead	2 to 4 ozs.
Hyposulphite soda	4 to 6 ozs.
Water	½ gal.

Use at about 180 degrees Fahrenheit.

—Walter Fraine.

Black on Aluminum

Q.—In one of your recent issues we noticed an article on a black finish on aluminum by chemical methods. Will you kindly submit the information regarding the black finish on aluminum such as used by name plate manufacturers in etching?

A.—Aluminum will take a black finish by immersing in a hot strong solution of caustic soda, 4 to 6 ounces per gallon. Relieve the high lights and lacquer. More enduring and pleasing blacks are obtained by plating in either of the two following solutions:

No. 1.	White arsenic	5 ozs.
	Caustic soda	5 ozs.
	Sodium cyanide	1 oz.
	Water	1 gal.

Dissolve caustic soda and arsenic in hot water; when cold add the sodium cyanide; use cold, at 1½ volts. Relieve and lacquer after plating.

No. 2.	Double nickel salts	10 ozs.
	Sulpho cyanide of sodium	2 ozs.
	Zinc sulphate	2 ozs.
	Water	1 gal.

Use cold, with nickel anodes, at not more than one volt tension. Relieve and lacquer after plating.

—Walter Fraine.

Dental Golds Stronger Than Steel

The New York Times of January 24, 1930, carried the report of an announcement to the effect that as a result of research by Professor R. C. Brumfield of Copper Union, New York, dental alloys of gold have been developed which rival steel in strength and other properties. It stated that nearly sixty gold alloys were developed in the Cooper Union engineering laboratories, each alloy having certain properties differing from the others. The strength of dental golds have been increased as much as 50 per cent and their ductility has been doubled in some cases. An alloy designed for springs to strengthen the teeth is stated to have load-bearing capacity of 130,000 lb. per sq. in.

Experiments with various alloying agents for gold were performed and results noted, the addition agents including such elements as palladium, copper, platinum, silver, etc. Professor Brumfield is quoted as saying that dental structures for use in the mouth are as complex from the engineering viewpoint as the construction of buildings, or bridges over rivers.

Rules for the Ingot Metal Trade

Texts of Rules Adopted at a Trade Practice Conference of the Ingot Brass and Bronze Industry in Conjunction with the Federal Trade Commission at Washington, D. C., February 6th, 1930*

1. It is the judgment of the industry that a knowledge of cost is indispensable to intelligent competition and the general adoption of uniform methods of cost accounting is recommended by the industry.

2. The defamation of a competitor in any manner, either by imputing to him dishonorable conduct, inability to perform contracts or questionable credit standing or a false disparagement of the grade or quality of his goods, or otherwise, is an unfair trade practice.

3. The making, causing or permitting to be made or published any false, untrue or deceptive statement by way of advertisement, or otherwise, concerning grade, quality, character, nature, origin, manufacture, or preparation of products is an unfair trade practice.

4. The imitation of the trademarks or trade names of a competitor results in deception to buyers and consumers, and is an unfair trade practice.

5. Interference with a competitor's business through the enticement of his employees from his employment is an unfair trade practice.

6. That the enticing or attempting to entice away the customers of any competing manufacturer of ingot brass and/or bronze by offering said customers special and unusual discounts on purchases, postdating invoices, and accepting long-term notes in payment for goods, when the said advantages are not offered to all alike is condemned by the industry.

7. Wilfully inducing or attempting to induce the breach of an existing contract by any means or device whatsoever, or interfering with or obstructing the performance of any contractual duty or service connected therewith, such breach or interference being for the purpose or with the effect of deceiving, destroying or appropriating, in whole or in part, the patronage, property or business of another engaged in the industry, is hereby declared an unfair trade practice.

8. That all ingot brass and/or bronze should be sold by grade or specification, and that the making of lump sum prices to cover the sale of two or more separate grades or specifications or entirely different kinds of merchandise prevents the purchasing trade from knowing the prices for said separate grades or specifications, and is condemned by the industry.

9. The sale of ingot brass and/or bronze conditioned upon the sale of any other commodity or manufactured article on which rebates, special prices or other concessions are allowed, when the same advantages are not extended to all customers alike, is condemned by the industry.

10. The giving of cash discounts or terms of net payment in excess of the usual and customary practice prevailing in the industry is condemned by the industry.

11. Contracts of sale which permit the buyer to cancel or provide for a reduced price in the event of a market decline but which do not permit the seller to cancel or provide for an enhanced price in the event of a market rise, are lacking in mutuality, and are condemned by the industry.

12. Directly or indirectly to give or permit to be given or promising to give to the agents, employees or representatives of customers or prospective customers, or the agents, employees or representatives of competitors' customers or prospective customers, without the knowledge of his employer, money or anything of value, as an inducement to cause employers or principals to purchase or contract to purchase ingot brass and/or bronze, or to influence such employers or principals to refrain from dealing or contracting to deal with competitors is an unfair trade practice.

13. The false marking or branding of products, for the purpose and with the effect of misleading or deceiving purchasers with respect to the quantity, quality, grade or substance of the goods purchased is an unfair trade practice.

14. That any contract or other form of order postdated or predated except to conform to a bona fide agreement for the purchase or sale of ingot brass and/or bronze on a predate, is hereby condemned by the industry.

15. The sale of an inferior quality of ingot brass and/or bronze at a price appropriate for such merchandise, and the delivery on such order of a superior quality of merchandise, selling at a higher price, is condemned by the industry.

16. The shipment or delivery of ingot brass and/or bronze not reasonably conforming to the specifications or samples submitted or representations made prior to securing the order, when done for the purpose and with the effect of deceiving the customer, is an unfair trade practice.

17. All smelters of ingot brass and/or bronze should sell their finished merchandise on the basis of f.o.b. destination. Railroad business may be excepted.

18. Selling ingot brass and/or bronze below cost for the purpose of injuring a competitor, or with the effect of lessening competition, is an unfair trade practice.

19. The acceptance of an order without a reasonable time limit for delivery and/or the acceptance of an order confirming delivery beyond such reasonable time, is a poor business practice, and is condemned by the industry.

20. (a) Withholding from or inserting in an order or invoice statements which make the order or invoice a false record, wholly or in part, of the transaction represented on the face thereof, is condemned by the industry.

(b) The secret payment or allowance of rebates, refunds, credits, unearned discounts, whether in the form of money or otherwise, or the secret extension to certain purchasers of concessions, services or privileges not extended to all purchasers under like conditions, is an unfair trade practice.

21. It is the judgment of the ingot brass and bronze industry that inasmuch as the manufacturers of ingot brass and bronze pay for their labor and raw materials on a cash basis, the giving or the allowing of any unreasonable discount or unreasonable time for net payment, is condemned by the industry.

22. (a) The industry approves the practice of each individual member of the industry independently pub-

* These rules have been taken under advisement by the Federal Trade Commission which will, in due course, give publicity to the texts as finally approved by it.

lishing and circulating to the purchasing trade his own price lists, and condemns any practice of publishing fictitious prices or prices not representative of the true prices of such manufacturer.

(b) The industry records its approval of the practice of making the terms of sale a part of any published price schedule.

23. By custom long established, the basic prices for ingot brass and bronze have been calculated on the basis of one or more carloads of minimum weight, and the making of prices for less-than-carload orders of ingot brass and/or bronze which do not recognize the proper differential existing in the trade for less-than-carload lots, is condemned by the industry.

24. (a) The making of contracts which do not expressly cover quantity, specifications, time limit for delivery, and other items necessary to form a complete, unambiguous contract, often results in price discrimination, induces fraud, breach of contract, and constant disputes, and is condemned by the industry.

(b) It is recommended by the industry that a standard form of contract which will avoid ambiguity, prevent misunderstandings, and thoroughly protect the rights of both buyers and sellers, be adopted.

25. Economical practice demands the manufacture and sale of ingot brass and/or bronze of commercially acceptable grades, and the acceptance of an order calling for specifications that are not within the limits of the generally recognized commercial grades at a price which does not properly reflect the additional cost of raw materials, labor, and supervision, is condemned by the industry.

26. The making of false reports of capacity, production, as well as orders, purchases, or shipments, is condemned by the industry.

27. A Committee on Trade Practices is hereby created and empowered to investigate and determine whether these resolutions are being observed, to make complaints concerning alleged violations, to cooperate with the Federal Trade Commission and generally to perform such other acts as may be reasonably necessary and proper to put these resolutions into effect and accomplish the objects and purposes of this conference.

Tin Rationalization

By A. EYLES

THE problem of rationalizing the tin industry in Great Britain has engaged much attention of late and some interesting suggestions are made in a little book "Rationalization of Tin," by A. P. L. Gordon, published at 2 shillings by the Saint Catherine Press, Stamford Street, London, S. E., England.

Mr. Gordon suggests the formation of an International Bank of Tin Control, without operating capital, raised within the industry and representative of the industry in the fullest sense, and he considers that the main economic problem of the industry resolves itself into the adequate (but not excessive) stimulation of prospecting. Mere output regulation is not enough. No scheme of price stabilization could stand up against an attack conceived on the lines of over-expansion in production through a boom. Mr. Gordon's arguments may be left to speak for themselves; apart from propaganda, the little book illustrates an interesting analysis of the tin industry.

It is pointed out that the marketing side of the tin mining industry is characterized by enormous fluctuations in the metal's price: for the past six years the range between the year's highest and lowest prices has never been less than £60 per ton; in 1924 it reached nearly £100. As a result of its being nobody's business to advance the interests of the industry, Mr. Gordon complains that tin, in all its uses, is negligently and carelessly applied. The writer's lengthy experience in the metal industry partly agrees with Mr. Gordon's last statement, as tin in a great many uses unquestionably is "negligently and carelessly applied."

Until recently, Mr. Gordon complains, "solder containing only 40 per cent of tin was freely sold as a fifty-fifty solder;" tin plate manufacturers do not know how, and do not attempt, to prevent the pin holes in the tin coating which render their product less marketable among can manufacturers; automobile builders are indifferent to the constitution and qualities of their bearing metals. If these patches of ignorance, he says, merely resulted in a waste of tin, the damage done would be real, if slight. They are, however, still more noxious, in that they limit the usefulness of the product. If all bearing metals were tested and the best used for each specific purpose, the demand for good bearings would increase; even if less tin were used in each bearing, there would be a larger aggregate demand. Similarly, if canning were rendered safer, there would be a larger pack of canned foods; the demand for tin plate would increase. If solder, of whatever composition, invariably did its work effectively, it would have a wider sphere of application.

American Prosperity

A very interesting comparison of the economic condition of the United States and the rest of the world was given by the Honorable Ogden S. Mills, in a speech at a luncheon given to him at the Union League Club in New York, by General Charles H. Sherrill, on February 4th, 1930. Mr. Mills, who is undersecretary of the Treasury, pointed out that the population of the United States constitutes about 7 per cent of the total world population; yet that 7 per cent consumes 48 per cent of the world's total production of coffee, 53 per cent of all the tin, 56 per cent of the crude rubber, 21 per cent of sugar, 72 per cent of the raw silk, 36 per cent of the coal, 42 per cent of the pig iron, 47 per cent of the copper, 69 per cent of the crude petroleum, and owns 75 per cent of all the automobiles in existence to-day.

In our January issue we published a comparative table of metal production and consumption statistics. In this table we showed that the United States consumes, in addition to the metals mentioned above, 37 per cent of the world's zinc, 52 per cent of the lead, and over half of the aluminum, nickel and platinum.

These figures present a startling picture of the prosperity of the United States as compared with other nations. Mr. Mills closed his speech on a reassuring note, as follows:

"At the present time, as we all know, we are experiencing a recession in trade and business, the extent of which it is impossible to estimate at this moment. But if we journey back to 1920 and then review, be it ever so briefly, all that has happened in the last ten years, I think you will agree with me that a man would indeed have to be one of pretty poor spirit and courage not to look forward to the future with complete confidence."

THE METAL INDUSTRY

With Which Are Incorporated

The Aluminum World, Copper and Brass, The Brass Founder and Finisher, The Electro-Platers' Review

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Editorial

Good Meetings on Metals

The Institute of Metals Division held three days of meetings in New York, a full report of which will be found on page 107 of this issue. The meetings were not only varied, covering many sides of the metal industries, but very high in the character of the papers presented. All classes had their day in court—the physicist, the metallographer, the chemist and the practical melting and operating man. It is noteworthy that the discussions were so numerous in the symposium on melting and casting metals as to force the meetings to overrun their time. There is no question about the interest of the metallurgist in the practical problems of melting and casting.

The outgoing administration of the Division, headed by S. Skowronski, is to be congratulated upon the unusually fine record they have made in the past two years. The Division has grown to be an important part of the Institute as a whole, as witnessed by the amount of space given by the Transactions to the Division papers, and the important part which even Division news and abstracts play in the Institute publication, Mining and Metallurgy.

It is gratifying also that good work is rewarded by something more than consciousness of virtue. W. H. Bassett, one of the senior members of the Division and an ex-chairman, has been elected president of the main body, the American Institute of Mining and Metallurgical Engineers. S. Skowronski, the retiring chairman of the Division, has been appointed chairman of one of the most important committees, Papers and Publications.

For the coming year, the Division affairs are in the hands of capable officials, led by Dr. Jeffries, and its progress should continue without pause.

Progress in the Ingot Metal Trades

In this issue on page 131 we publish a set of tentative "rules" for the ingot metal trades, the first of its kind ever promulgated. A few months ago the Special Committee of the American Society for Testing Materials for the Promotion of the General Use of Specifications for Copper Alloys in Ingot Form, met to continue its work in reducing the number of alloys and mixtures in use and to stabilize the industry on the least possible number of standard alloys of standard quality. The Institute of Metals Division of the American Institute of Mining Engineers has held several sessions devoted exclusively to secondary metal smelting and refining. Two new organizations have recently been formed, the Aluminum Research Institute and the Institute of White Metals, both in the secondary metal field.

What does all this point to? It means that the secondary metal industry is in process of stabilization. It is not an easy task or one which will be effected overnight, but it is sure to come. It is too large an industry to be carried on in the helter-skelter and cut-throat style which has existed in the past.

Perhaps, eventually, some of the organizations operating in the various branches of the industry such as red metals, white metals and aluminum may be combined in the interests of economy and more concentrated effort. For the present moment, however, it is sufficient that the trade is alive to the advantages of cooperation over unthinking competition.

The Silver Market

We have an anomalous condition before us in the silver industry. Here is a metal, to which the public has been thoroughly educated and which is selling in larger quantities every year. At the same time, the price has dropped, slowly for some time, but recently with alarming speed. The reason, which is generally known, is its steady demonetization throughout the world; in other words, its displacement as a coinage metal.

The situation is decidedly embarrassing to the producers of silver, and at the same time the manufacturers who are forced to write off heavy inventory losses. Needless to say, it is an extremely serious matter for those countries in which silver is an important item, such as Mexico for its mines and India and China in the matter of its general use. The United States also suffers because of its large production of silver and the large manufactures which have been built up on this metal.

It is an emergency which has long been foreseen. Perhaps the recent decline was sharper than anyone expected, but the fact is that silver has been a little unsteady for some years.

Being an international commodity, silver cannot be controlled by one nation or locality. The only salvation for the industry is group action, if it is to continue to be produced on its present scale. Complicated as the industry is by the fact that silver is produced as a by-product up to a large proportion of its total output, it behooves those organizations to which silver is vital to get together with as little delay as possible. Most of the world's silver is mined and recovered in North and South America and these producers should be the first to start co-operative action.

Aluminum Structural Shapes

The description of the new rolling mill of the Aluminum Company of America at Massena, N. Y., published on page 121 of this issue, will open the eyes of many to a development of far-reaching importance. Aluminum is now being rolled commercially into structural shapes.

There is no one who cannot visualize the enormous possibilities in this outlet for the light metal, if the greater expense is counterbalanced by the advantage of lightness which allows for higher speed in vehicles and less dead load

in construction. According to published reports, beams of aluminum alloys weigh only half as much as their exact steel counterparts and yet carry 13 per cent more load. Pound for pound, the aluminum alloy will support 130 per cent more than steel.

We may yet see tall buildings using aluminum alloys in their structural members. What does seem to be fairly close, however, is the use of aluminum in the construction of railroad cars and motor trucks.

Competition Stimulates Research

The plating industry has a problem looming up before it, of larger proportions perhaps, than it has ever before had to meet. A competitor has appeared in the form of a metal, "corrosion-resistant" "non-tarnishing," etc.,—the 18 chromium, 8 nickel, balance iron, alloy. The friends of this metal point out that there is no plate to peel or wear off; that the metal can be polished and left alone.

This is no light argument to overcome. What is the electroplating industry going to do about it? Obviously there are several roads open to it. Standard forms of electroplating must be improved. Plating should be made heavier, more adherent, better looking and more permanent. Costs can be held down or even cut by the use of improved equipment and methods. New types of plating and plated finishes can be worked out. Old troubles, such as peeling and spotting may be reduced to a minimum or eliminated. The standard of plating in general should and will be raised, perhaps by the adoption of standards, and certainly by the improvement of quality. Eventually there will be specifications for the permissible minimum thicknesses of plates. Perhaps it may even be possible to deposit the new stainless iron.

And how is all this to be done? There is only one sure method—by organized, intelligently directed research. Every large organization has its own research department, but is forced to keep it busy on the practical problems of everyday business as they arise. The big problems of the industry must be met by the industry as a whole, co-operatively. It is cheaper and gets better results.

The Research Fund of the American Electroplaters' Society provides the best possible means of meeting such a situation. It deserves the whole-hearted support which it will undoubtedly receive from electroplaters, electroplating firms, supply houses and manufacturers in general. The electroplating industry cannot afford to allow this Research Fund to fall behind its program.

Why Chromium Plating Fails

From various parts of the Middle West we have scarehead reports that chromium plating is a failure. It peels, scales off and rusts, according to these "reporters." The automobile companies are among the chief sufferers, and chromium plating has fallen into disrepute.

There is no question that some of the automobiles have come out with very poor excuses for chromium plating. There has been much peeling and rusting. And what is the reason? Ask the purchasing department of the automobile company that places its contracts for plating only with the lowest bidder; that has no specifications or standards for plating; that buys chromium plated work by the pound like gravel.

It is an old story that the lowest bid on any job is not reliable; that it is impossible to do good work at less than cost. The trouble is not with chromium plating but with the chromium platers who do poor work at ruinous prices, and with the manufacturers who encourage them by placing their contracts on price alone.

Chromium plating on automobiles will improve when it is bought on a fair basis. Eventually, the purchasers must find out that they cannot get something for nothing.

Platers' Society of Age

The recent meeting of the New York Branch of the American Electroplaters' Society marked the twenty-first year of the existence of that organization. The American Electroplaters' Society has reached its majority. It has grown to undreamed of proportions in size and influence and it has done a vast amount of good to electroplaters and to the industry. It has been successful beyond the hopes of its most optimistic charter members.

So much for the past. The future, full of possibilities and full of dangers is before it. Although the Society has done so much work in the past, still more and harder tasks await it. As George Gehling so aptly stated at the meeting, "The Platers' Society has grown up to be a man. Now it has to do a man's work."

Mr. Gehling was right. There is little time to waste thinking about past accomplishments. All eyes must be turned to the future.

Do It Now!

Business is gradually but steadily improving. There in no sharp pick-up. There is no rush of orders. But there is a strengthening of the underlying factors and a marked improvement in the basic industries. Steel mills are speeding up, and while their gains have not spread throughout all industry, nevertheless, the prospects are far from discouraging.

There is still need, however, for further improvement and that improvement could be hastened by putting plans into work without delay. If equipment needs replacement, do it now. If a new building has been planned, build it now. If the plant is not busy, this is the time to make replacements and improvements. Make them now. It is less expensive than when every machine is going to capacity.

This is not an appeal to expand unnecessarily. Our salvation consists of keeping our capacity within reason, not outstripping demand, but keeping plants and machines in the best possible condition, with the most economical layouts, working under more modern and efficient conditions.

The business slogan for the moment should be, "Do it now!" Do nothing that is not necessary, but once a decision has been made, no time should be lost in putting it into effect.

Correspondence and Discussion

Chromic Acid Determination

To the Editor of THE METAL INDUSTRY:

The following procedure, which the writer has used for several years, might be helpful to chromium platers for ascertaining the chromic acid content of solutions.

A solution of CrO_3 in water, with small amounts of other matter and CrO_3 in excess, the per cent of chromic acid is exactly equal to the Baumé reading. A short table is herewith given:

Lbs. CrO_3 per Gal.	Per cent CrO_3	Baumé
1.5	16	16
1.75	18	18
2.0	21	21
2.5	25	25
3.0	29	29
3.5	33	33
4.0	37	37
4.5	40	40

The above takes in consideration a sulphate content approximating ¼% of the CrO_3 content and ½ ounce each of boric acid and iron chromate, or in place of these three addition agents, the usual amount of ferrous chrome oxalate.

Chicago, Ill.,
February, 1930

LESLIE L. LINICK.

Black Nickel Solution Formula

To the Editor of THE METAL INDUSTRY:

I have been using the following formula for a black nickel plating solution for some time and find it satisfactory in every respect:

Double nickel salts	8 oz.
Zinc sulphate	1 oz.
Carbonate of copper	⅛ oz.
Sulphocyanide of potash	2 oz.
Water	1 gal.

Voltage, ½ to 1; amperage, 10 to 15 per square foot.

Chicago, Ill.,
February, 1930

ANDREW V. RE.

Technical Papers

Bibliography of Electro-Deposition of Nickel. By D. T. Ewing, J. E. Archer and H. Shadduck, Department of Chemistry, Michigan State College, East Lansing, Mich. Bulletin No. 26, Michigan Engineering Experiment Station. Free on request.

A very complete bibliography covering articles, pamphlets and books on the subject of nickel plating. There is a good index of subjects so that any phase of the science can be found in the bibliography.

Deoxidation of Copper with Calcium. By Earle E. Schumacher, W. C. Ellis and J. F. Eckel, Bell Telephone Laboratories, Inc. Reprint of a paper presented before the Institute of Metals Division. Issued by Bell Telephone Laboratories, Inc., 463 West Street, New York. Free on request.

An investigation of deoxidation of copper with calcium and properties of some copper-calcium alloys.

Effects of Cold Working on Physical Properties of Metals. By R. L. Templin, New Kensington, Pa. Technical Publication No. 238, American Institute of Mining and Metallurgical Engineers, New York.

This is a theoretical discussion of the effects of cold working on the physical properties of metals. The author discusses the factors that must be considered simultaneously with cold working, defines cold work and equivalent cold work before deducing his formulas and giving experimental results. The discussion is included with the paper and R. S. Dean presents the view that tensile strength, elongation or reduction of area should not be considered measures of cold work in the metal.

Welding and Cutting Nomenclature, Definitions and Symbols. Bulletin of American Welding Society, 33 West 39th Street, New York. Price, 50 cents.

This bulletin has been under preparation by the American Welding Society for the past three years. The text, exclusive of the index, consists of 43 pages, with numerous cuts. It is divided into four sections. Section I, covers Nomenclature; Section II, Definitions of general welding terms, processes, forms of joints, forms of welds, and equipment and supplies; Section III, Abbreviations; and Section IV, Symbols.

Under Nomenclature in Section I, the names of the principal welding processes are given in full and there is a schematic diagram of the principal welding processes illustrating graphically their inter-relation. The definitions in Section II and abbreviations in Section III are profusely illustrated so that there can be no misunderstanding of what is meant. Finally the symbols in Section IV are for use in connection with the resistance and fusion welding processes.

Progress Report on Investigation of Fireclay Bricks and the Clays Used in Their Preparation. By R. A. Heindl and W. L. Pendergast, United States Bureau of Standards, Washington, D. C. Superintendent of Documents. Price 15 cents.

This is a progress report of an extensive study of fire clays and fire-clay bricks. It includes the results of a preliminary study of clays representative of those used in the manufacture of refractories throughout the United States. Chemical analyses and a summary of physical tests are given of both fire clays and the bricks manufactured from them. The thermal expansion behavior of the fire clays fired at 1,400° C. and those of the fire bricks "as received" from the manufacturer and also after firing at 1,400°, 1,500°, and 1,600° C. were studied and the materials classified into groups having characteristic thermal expansions. The moduli of elasticity and rupture were determined at 20°, 550°, and 1,000° C. The resistance of the brick to spalling in a water-quenching test is expressed in an empirical relation correlating the elasticity, strength, coefficient of expansion, and percentage of grog used in compounding the brick batches.

Index to A. S. T. M. Standards and Tentative Standards. Published by American Society for Testing Materials, Size, 6 x 9; 109 pages.

The index is issued yearly; this one constitutes the combined index to all A. S. T. M. standards and tentative standards in effect as of September 3, 1929.

Brass, Wrought Iron and Steel Pipe Nipples. Proposed Federal Specification, Federal Specifications Board, Washington, D. C. Free on request to Board. Also: Resubmission of **Proposed Federal Specification for Terne Plate (Roofing Tin)**; Resubmission of **Proposed Revision in Federal Specification for Copper Pipe and Tubing** in Standard Seamless Iron Pipe Size.

Metallographic Polishing.—1. Automatic Metallographic Polishing Machine. By S. Epstein and John P. Buckley, United States Bureau of Standards, Superintendent of Documents, Washington, D. C. Price, 10 cents.

An automatic metallographic polishing machine, designed particularly for studying polishing methods, but which should be useful in any metallographic laboratory, is described. The metal specimen is mounted in a metal ring and held in an arm which moves it back and forth along a radius of the turning polishing disk. At the same time the specimen is rotated. There are three arms to a disk, so that three times as many specimens as there are disks in the machine can be polished at a time. A high quality polish, free from pitting and scratches, is obtained. An outline of the proposed study of polishing methods is given.

Shop Problems

This Department Will Answer Questions Relating to Shop Practice.

Brass Plating Cast Iron

Q.—I would like to get some information on plating iron castings such as lamp bases and sheet steel. I can only plate four bases at a time, 5 to 10 minute plate, and it seems the longer it plates the redder the color becomes in center of casting. I cannot get that nice brass color all over, even if I give it all the current, unless I plate one at a time, and that would not pay me. If I use more arsenic and caustic, my work shows dull white and still I would have that red color in the center of the casting. Should I use a different solution for this kind of work? Maybe I'm not using enough copper each week. If so, please state the amount I should use.

My rheostat is a 6 volt, 100 ampere type. The bath is 18 in. x 54 in. by 24 in. depth; 80 gallons solution; sodium cyanide, 50 oz., copper cyanide, 3 oz., bicarbonate of soda, 1 oz., ammonium chloride, ½ oz.

A.—Your solution as given above is entirely out of balance as regards copper cyanide and sodium cyanide. As given, it is a straight copper plating solution, as no zinc salts are indicated. Possibly this is a copper solution which is used to get a base coat in preparation for the brass? Your letter suggests that your brass solution has been brought to a condition where it develops what is called a "zinc red," aggravated by too much caustic and arsenic, which in excess are detrimental.

It would probably be more economical to throw the solution away, unless you can secure an analysis of the copper, zinc and metal content, and then make the necessary adjustment.

We suggest that you make a new solution as follows:

Copper cyanide	3 oz.
Zinc cyanide	⅔ oz.
Sodium cyanide	8 oz.
Sodium carbonate	1 oz.
Water	1 gallon

Use at about 100° to 110° F., with 3 to 3½ volts. Use electrolytic copper anodes instead of brass anodes. This will maintain the solution in copper, requiring the addition of zinc cyanide only to maintain the color. If arsenic is added for a brightener, it is necessary to avoid any excess which will affect the color. This solution should give you the color and the results you desire.

—W. F., Problem 3,943.

Correcting Nickel Solutions

Q.—We are sending two samples of nickel solution. The one marked No. 1 was taken from still tank and was made up the regular way, but it seems to have become out of balance some way and plates dark and peels very easily. Sample marked No. 2 was taken from barrel plater and is also not working satisfactorily.

We would appreciate it if you would analyze these and give us the information for correction.

A.—Analyses of nickel solutions:

No. 1 Metallic nickel	7.89 oz.
Chlorides	1.26 oz.
pH	5.4

The chloride content and the pH are too low. Would suggest that you add 1½ oz. sodium chloride to each gallon of solution and also raise the pH by adding 8 oz. of 26° ammonium hydroxide to each 100 gallons of solution.

No. 2 Metallic nickel	4.82 oz.
Chlorides	0.71 oz.
pH	6

The metal content and pH are about right, but the chloride content is too low. Add 2 oz. sodium chloride to each gallon of solution.

—O. J. S., Problem 3,944.

Hot Galvanizing

Q.—Can you give us a formula for hot galvanizing small pieces of cold rolled steel in limited quantities, or can zinc with the proper admixture of lead be reduced to a galvanizing solution.

If a solution is practicable we would appreciate your formula.

A.—A combination zinc and lead galvanizing bath is not practicable for the reason that lead is of a higher specific gravity than zinc and remains in the bottom of the kettle. No amount of stirring will mix it sufficiently to maintain any lead in solution with zinc. Its only purpose in a galvanizing bath is to form a cushion to prevent the dross formed from dropping to the bottom of the kettle, this serving as a protection to the bottom of the kettle. Incidentally, it permits easier removal of the dross when redrossing.

In preparing a kettle for filling, lead should be put in first to a depth of from six to eight inches when molten. Scrap lead may be used for this purpose. The zinc should be Prime Western spelter and should be packed on edge against the sides of the kettle evenly. This will lessen the danger of burning out the kettle in its first heating.

The heating should take place slowly, allowing forty hours or more to bring the kettle up to the required temperature. When up to heat required, sprinkle over a part of the surface with gray sal ammoniac to form a flux to keep the zinc from oxidizing and to prevent any oxidized zinc from sticking to the parts to be galvanized when putting work into the kettle. As soon as the sal ammoniac is melted, add a small amount of glycerine to thicken it and cause the flux to remain fairly stationary, so that part of the kettle which has been skimmed to draw out the work will be free from flux. The use of the flux permits more even and smoother coatings. Add fresh sal ammoniac as needed.

Temperatures for galvanizing vary according to the kind of work to be done. In brief, heavy and bulky parts require lower temperatures and longer immersion, ranging from 850° up. For sheet steel and parts fabricated from sheet steel the temperature should be from 900° to 925° F.

It is assumed that you are familiar with the usual methods of handling work through the various operations required for galvanizing, so mention of these is omitted.—W. F., Problem 3,945.

Hot Tinning Strip Steel

Q.—We are trying to hot tin some flat cold rolled strip steel, but so far have not been able to get the results desired. The tinned surface seems to develop small blisters or pin holes, and rust soon appears. Another defect in the tinned surface is at a point where it is necessary to lap or join the coating, due to the part being too long for the pot, which makes it necessary to immerse each end. The tin at this point seems to break, giving the surface a "crackly" appearance and leaving the tin coat very thin at one point and much too heavy at another.

Would you kindly advise as to a method to follow to obtain the best results?

A.—To secure a good looking product in hot tinning it is necessary to use at least two tinning kettles, the first (or roughing) kettle being maintained at 500° F. and the second (or finishing) kettle at 400° F.

To produce an even coating of tin on long strips of steel it is essential that the kettles be of sufficient size to immerse the entire strip. Where this cannot be done and it is necessary to immerse first one end and then the other, the difference in temperature in the strip above the tin is sufficient to prevent the tin from flowing smoothly, making a lumpy lap. The lap joint is almost certain to pick up some of the dross from the surface of the molten tin unless great care is used to skim the dross from the surface surrounding the sheet steel.

The sequence of handling sheet steel for hot tinning is as follows:

Remove all grease in hot caustic solution; if the sheets have rust or scale on them, pickle in one part muriatic acid to 8 or 10 parts water; rinse in cold water; dip in a concentrated solution of muriate of zinc containing five pounds of gray granulated sal ammoniac per gallon. Next, transfer to the first (roughing) kettle until the sheet has been brought up to the temperature of the tin. Next, skim dross from surface where the sheet is drawn out and transfer to the second (finishing) kettle, allowing sheet either to lower or to rise to the temperature of the tin, viz., 400° F. Remove sheet, shake off surplus tin, and place in tank of kerosene to cool. Dry off in soft wood sawdust and finish by rubbing with flour.

One of the essential points in securing a successful coating of tin is the proper consistency of the flux. The flux is made by boiling a quantity of muriate of tin of the molten tin and adding quickly some white granulated sal ammoniac before the acid muriate is evaporated by the heat of the tin. Trial alone will determine the proper consistency.

Blisters may be caused by fire scale, which must be removed by pickling, or by pin holes in the stock not filling up, allowing rust to set in at such places. The sheets should be inspected before tinning and the pin holes scraped out.

—W. F. Problem 3,946.

Marbled Finish on Metal

Q.—Will you kindly inform us how to marbleize metal novelties such as bookends, etc. We have seen some very beautiful designs and they look almost as good as marble.

A.—Silver plate or copper plate the articles as usual for oxidizing. Next, oxidize with polysulphide or sulphuret of potassium, using a cold solution for copper and a warm solution (110° to 125° F.) for silver.

Next, take a coarse, open sponge and trim one side flat. Dip sponge in a weak cyanide of sodium dip and squeeze out the excess solution. Lay the sponge flat face down on the oxidized surface to dissolve the oxidize down to the copper or silver deposit, giving a mottled surface. Rinse quickly in cold water, scratchbrush as usual, dry and lacquer.

—W. F., Problem 3,947.

Nickel Peels in Chromium Bath

Q.—We are sending you a sample of our nickel solution, and would like very much to have you make an analysis of same.

We are having trouble with the nickel peeling on work that we send out to be chromium plated, and would be very grateful to you if you could give us some idea as to what the trouble is, and what additions to make to bring the solution up to standard for this kind of work.

A.—Analysis of nickel solution:

Metallic nickel	3.94 oz.
Chlorides	6.81 oz.
pH	5.2

The pH of the solution is too low. We would suggest that you add 8 oz. of 26° ammonia to each 100 gallons of solution and heat the solution to 100° F. As the chloride content of the solution is also too high, do not add any more chlorides for some time.

—O. J. S., Problem 3,948.

Oxidized Silver Plate

Q.—I would like to obtain information regarding an oxidize for silver plated work. At present I am using "Platin-Nig." This requires a heavy plate. I would prefer an oxidize that would give a good black appearance on a thin plate and could stand an ammonia wash.

A.—"Platin-Nig," polysulphide, or sulphuret of potassium are standard materials used for oxidizing thin silver deposits. These solutions form a chemical combination with the silver and produce a coating of silver sulphide on the parts oxidized. In doing this a portion of the silver deposit is combined with the sulphur in the oxidizing agent. Too thin a deposit will result in cutting through in relieving the work.

One way to reduce the silver cost is to deposit an under-coat of nickel, sufficient to prevent the cutting through to the base metal when relieved. To do this properly, the work, after nickel plating, is run through a silver strike composed of:

Chloride silver	1 oz.
Sodium cyanide	7-8 oz.
Water	1 gal.

Use large anode surface of silver or silver and steel anodes, 6 volts pressure.

Plate the required length of time in the silver bath, oxidize, relieve, and lacquer.

—W. F., Problem 3,949.

Oxidizing Brass

Q.—We enclose a brass shell. Please inform us as to the proper oxidize formula for this finish. The work is sand blasted, oxidized, and dry scratchbrushed.

We wish to use the same methods on brass and brass plated work and assume that the same oxidize will be satisfactory for both.

Do you know of a satisfactory black oxidize dip for nickel plate?

A.—The finish on the sample shell was produced in the following solution, used at a temperature of 180° F.:

Hyposulphite soda	8 oz.
Nickel sulphate	1 oz.
Potassium chlorate	1 oz.
Water	1 gallon

Scratchbrush lightly on a fine crimped brass wire wheel operated at 800 r. p. m. If the base metal to be used is steel, quite a heavy deposit of brass will be required.

We do not know of any satisfactory black oxidize dip for nickel plate. Why not use a black nickel solution?

—O. J. S., Problem 3,950.

Scum in Nickel and Gold Baths

Q.—I have a nickel solution made up of single and double nickel salts, salt and boric acid. I use that solution in a tumbling plating barrel with a metal bottom. When the barrel is not running, the nickel bottom gets reddish looking and also forms a yellow scum. Please tell me the cause. I always throw the scum away. Please tell me if the scum is of any harm to the solution.

I also have a gold solution which I made myself by cutting down my own gold. When the gold is run down, it forms a scum. What is that scum and what causes it? I make it up of cut down gold and cyanide.

A.—We do not understand why the metal bottom of your plating barrel acquires a red color when the barrel is not in use, as the bottom of the barrel, being metal, should receive the bulk of the nickel deposited. All the metal you should have on the bottom is just enough around the edge to carry the current required.

The yellow scum you mention is caused by sub-oxides forming and does no harm. This is due to the robbing of the solution of the acid content and can be remedied by keeping the solution at the proper pH of 5.7 to 5.8.

The scum on your gold solution is largely due to the accumulation of carbonates, or from the use of hard water. Filter the solution when cold to clean it up and if there is any hardness in the water you are using, boil it to precipitate the lime and magnesia it contains before adding to the solution.

—W. F., Problem 3,951.

Patents

A Review of Current Patents of Interest

Printed copies of patents can be obtained for 10 cents each from the Commissioner of Patents, Washington, D. C.

1,729,643. October 1, 1929. **Mold for Casting Metals.** Marius Guyot, Cleveland, Ohio, assignor to Aluminum Company of America, Pittsburgh, Pa.

In a permanent mold for making two piston castings simultaneously, the combination of a mold base and two mold halves, the adjacent faces of the mold halves being cut away to form gate, riser, and casting cavities for two piston castings, the gate cavity comprising a single inlet passage and two passages disposed between the casting cavities, each passage leading into a riser adjacent to and in communication with a casting cavity.

1,730,349. October 8, 1929. **Electrodeposition of Chromium.** Rudolf Auerbach, Probstdeuben, near Leipzig, Germany, assignor, by mesne assignments, to Chromeplate, Inc., Union City, N. J., a Corporation of New Jersey.

The process of electro-depositing chromium, which consists in adding to a solution of chromic acid containing a free, highly dissociated acid a salt of an acid with a dissociation constant less than the dissociation constant of phosphoric acid with relation to the first hydrogen ion liberated therefrom, to decrease the concentration of the hydrogen ions.

1,730,775. October 8, 1929. **Method of Freeing Copper From Copper Oxide.** Hiram S. Lukens and Russell P. Heuer, Philadelphia, Pa.

The process of removing copper oxide from molten copper continuously, which consists in covering the molten copper bath with slag capable of dissolving the copper oxide from the copper, using the slag to dissolve the copper oxide, removing a portion of the slag with its content of copper oxide and supplying fresh slag to maintain the activity of the slag.

1,731,169. October 8, 1929. **Method of Casting Articles of Precious Material.** Emile Liebert, Los Angeles, Calif.

The method of casting jewelry which consists in first producing half of a ring finished in all its fine ornaments, placing this half-ring on a base and filling its inside cavities with pliable material so as to form core and gate projections outwardly, applying molding material over the ring-half and filling in the base to form a temporary mold, pouring metal material into this mold to form a master plate, casting mold-halves over this master plate, placing the ring-half into a mold-half and producing a core, placing the core into the mold halves, depositing this combined mold and core structure into a casing-mold with a recess in its top end and then placing this under a pressure apparatus, then placing material of which a piece of jewelry is to be made in the said recess, then applying heat until the material placed in the recess is melted, and then closing the pressure apparatus upon the recess and operating the pressure apparatus to force the melted material into the mold and around the inserted core.

1,731,210-13. October 8, 1929. **Gold Alloy.** Victor D. Davignon, Attleboro, Mass., assignor to General Plate Company, Attleboro, Mass., a Corporation of Rhode Island.

A substantially homogeneous, malleable and ductile gold alloy containing by weight about 58 per cent gold, 8 per cent copper, 3 per cent magnesium, 5 per cent zinc, and the remainder silver.

1,731,333. October 15, 1929. **Lacquer.** Joseph G. Davidson, Yonkers, N. Y., assignor to Carbide and Carbon Chemicals Corporation, a Corporation of New York.

A thinner for pyroxylin lacquers comprising not substantially more than 30 per cent of ethyl accetate and ethyl alcohol, not substantially more than 20 per cent of monoethyl ether of ethylene glycol and the acetate of monoethyl ether of ethylene glycol, and the remainder a suitable hydro-carbon solvent.

1,731,365. October 15, 1929. **Method of Refining Lead.** John P. Walker, Hammond, Ind.

Method of refining lead which comprises contacting lead in the molten state with a hydrated compound which is infusible at the temperature of the lead bath.

1,731,415. October 15, 1929. **Production of Electrolytically Deposited Gold in Film or Leaf Form.** William F. Grupe, Rutherford, N. J.

A heat releasable transfer strip comprising a strip of inert material serving as a carrier, a layer of heat releasable medium on one face of the same and a substantially continuously integral layer of gold disposed on said layer of heat releasable material, said layer of gold having a length materially greater than that of beaten gold.

1,731,456. October 15, 1929. **Chromium-Plating Machine.** William S. Eaton, Sag Harbor, N. Y.

A chromium plating machine embodying therein adjacent tanks adapted respectively to receive a cleaning, a rinsing and a plating bath, a holder for articles to be plated, means supporting said tanks with the open tops thereof at a height to permit the convenient transfer of said holder from one tank to another, fixed means forming a housing above said tanks having a closed top and an opening at the front thereof through which access may be had to said tanks.

1,731,608. October 15, 1929. **Abrasive Compound.** Joseph N. Bourg and Wesley A. Richards, Detroit, Mich., assignors to Park Chemical Company, Detroit, Mich., a Corporation of Michigan.

A compound adapted for use in the smoothing or cutting down of painted, varnished, or lacquered surfaces consisting of kerosene 28 per cent, water 28 per cent, abrasive 42 per cent and soap 2 per cent, said soap being present in high enough concentrations in the water phase to form a jelly and thus hold the kerosene and abrasive in permanent suspension.

1,732,327. October 22, 1929. **Alloy and Process of Heat Treatment.** Michael G. Corson, Jackson Heights, N. Y., assignor to Electro Metallurgical Company, a Corporation of West Virvinia.

An alloy comprising nickel 40 to 80 per cent, silicon 1.5 to 10 per cent, balance principally copper, with the ratio

$$\frac{\text{Ni percentage}}{\text{Si percentage}}$$

falling within the range 7 to 28.

1,732,504. October 22, 1929. **Method and Apparatus for Coating.** Charles A. Davis, Youngstown, Ohio.

In the method of galvanizing, the steps consisting in subjecting an article to the action of a bath of coating material, removing the coated article, subjecting the coated article to sufficient heat in excess of the bath temperature to prevent crystallization, and thereafter gradually cooling the coated article by applied heat, substantially as described.

1,732,727. October 22, 1929. **Aluminum Solder.** Arthur James Line, Edgbaston, England.

A solder for aluminum and its alloys consisting of a composition of approximately 3 parts by weight of silver and approximately 12 parts by weight of aluminum.

1,732,839. October 22, 1929. **Metal Alloy for Use in Manufacturing Electrical Contacts.** Hardy M. Fredriksen, Seattle, Wash.

A metal alloy comprising the nodule material left from electrolyte copper refining and silver in substantially the proportions of 80 per cent of silver and 20 per cent of the nodule material.

1,733,404. October 29, 1929. **Process and Apparatus for Electroplating Tubes.** Frank A. Fahrenwald, Chicago, Ill.

The process of electro-plating the interior of a tube which contains the steps of continuously passing a moving stream of plating solution through such tube in contact with the walls thereof and simultaneously electrolyzing such solution between such tube as cathode and an anode which is short as compared with the length of the tube, and moving such anode gradually through the tube during such electrolysis while producing a relative rotation between the tube and anode about the tube axis.

Equipment

New and Useful Devices, Machinery and Supplies of Interest

Polishing and Buffing Lathe

The new type electric polishing and buffing lathe shown in the accompanying illustration has just been designed and placed on the market by the Hammon Machinery Builders, Inc. (formerly Hill-Curtis Company), Kalamazoo, Mich., who market it as another of their "Rite-Speed" line of equipment. This is stated to be a self-contained machine for alternating current service with spindle speed practical for average work. It was designed to answer the old problem of correct speed and efficiency for general service in the polishing room. In this regard, the announcement of this equipment says:

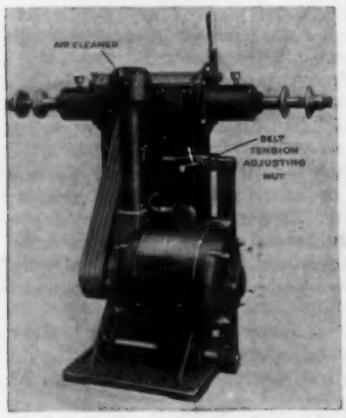
"Efficient polishing speed is usually 2,000 to 2,400, and for buffing 2,400 to 3,000 r.p.m. It is impossible to obtain these efficient speeds with a motor-on-spindle type polisher, unless large expenses are made for auxiliary speed control equipment. With the "Rite-Speed," any speed desired can be had. Speeds can be changed by changing pulley on motor. The power is transmitted from the motor to the spindle by means of the multi-V belt drive, which is silent, non-slipping, and long lived. A few of the outstanding features are as follows:

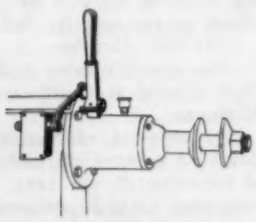
"Large batteries can be placed with a minimum amount of floor space used as this design has motor on rear of pedestal. The same clearance is maintained between the wheel and obstruction, but reduced floor space is permitted by not mounting the motor inside of the pedestal, a saving of anywhere from 8 to 15 inches is made on each machine, without sacrificing clearance around spindle. With this method of mounting the motor, belt tension adjustment are made by a single adjusting nut, without disturbing the motor mounting. Motor is totally enclosed and fitted with motor air cleaner which discharges dirt and dust before it enters the motor windings. Unlimited radiation keeps motor cool.

"Another outstanding feature is the ease with which belts can be changed. By removing the four large cap screws on each side of it, entire spindle can be removed from the pedestal without disturbing the bearing mounting, or sub-assembly parts. The motor adjustment screw is then loosened, thereby taking the tension off of the motor pulley, and the belt slips off the spindle.

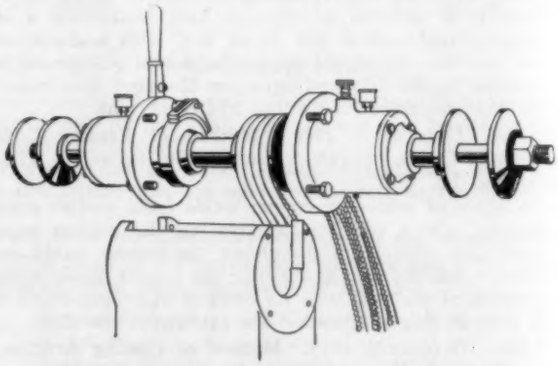
"The combination switch and brake is a new feature on all 'Rite-Speed' polishing machines. With this design it is only necessary that the operator pull the lever forward to break the current connection and apply the brake. The brake is released and the motor started by reversing this operation."

Either Timken tapered roller or ball bearings automatic motor starter, flat-top threads, and spindle lock are standard equipment. The machines can be supplied with motors from 3 to 15 H.P.





Above, Switch and Brake Combination, and, at Left, Rear View of New Polisher, with Belt Guard Removed



Spindle and Bearing Housings

Chemical Control Set for Nickel

A method of accurately analyzing, correcting and maintaining at the highest point of efficiency all nickel plating solutions is being offered to the plating industry by Chromium Service and Sales, Incorporated, 14th Street and Marion Place, Long Island City, N. Y. This method is stated to be the result of exhaustive study, and over a year's time in research under the direction of Dr. L. C. Pan, author of "Simplified Methods of Chemical Control," and instructor in electroplating at the College of the City of New York.

By this method, Dr. Pan has reduced the operations of chemical analysis, control and maintenance of nickel solution to a minimum so that anyone, with no chemical knowledge, can make an accurate analysis and make corrections of the three essential elements of the nickel bath, the nickel content, the chlorine content, and the alkalinity, in about 15 minutes, it is claimed. The results are given in the following forms:

1. Nickel content in terms of nickel metal, single salt or double salt.
2. Chlorine content in terms of chlorine, ammonium chloride (sal ammoniac), nickel chloride or sodium chloride.
3. Alkalinity in terms of ammonia water or equivalent of ammonia water.

In this, no figuring or calculation is involved. To enable electroplaters to make use of this highly simplified method of control, Chromium Service and Sales, Incorporated, provides a complete outfit, under the name "C. S. & S. Chemical Control Set for Nickel Plating Solutions," in a compact form. The set consists of necessary apparatus, reagents and charts with instructions of utmost simplicity, it is stated. A special correction table is furnished with each set and is calibrated to each individual tank at the customer's shop, so that the operator can see at a glance the proper amount of addition to be made to each tank.

The bench space required for the apparatus and reagents is not over 1½ sq. ft. Daylight or special lighting is not required to carry out the tests with this act, the company states.

Body "Deadener" Sprayed on Fords

The illustrations here show the equipment used at the Rouge Plant of the Ford Motor Company for applying "Inco" body deadener on the inside of automobile bodies to dampen vibration or rumble. The 200 gallon tank and the spray gun are manufactured by the Paasche Airbrush Company, 1909-1923 Diversey Parkway, Chicago, Ill., widely known airpainting equipment manufacturers.

The tank, Type F539, according to the manufacturer, is mounted on a balcony above the body line and has a 3-in. pipe

Above—Special Air Gun and Extra Nozzles for Spraying Deadener. At Right—Pressure Tank

at the base that branches to each side of the body line. The 200-gal. tank has a 25-in. cover so that the deadening material can be hoisted and dumped therein directly from barrels; three barrels of 55 gal. each are dumped into the tank before beginning operations. A 1¼-in. "pressure hose" is connected by a ¾-in. reducer to the special Type UUE air gun which has a ⅜-in. nozzle.

According to information supplied by the manufacturers, the deadening material is sprayed on the interior of the body after it has been painted and all "dings" has been eliminated, because it is impractical to "ding" a body after the inside has a ¼-in. coat of sticky deadening material.

After the body of the automobile is sprayed with deadener, it continues along the line and is upholstered and assembled on the chassis in the regular manner. It is not necessary to spray the entire inside area with deadener, and the operator endeavors to keep this material away from the outside corners, door fixtures, etc., in order that the latter may be operated. The "Inco" body deadener is made by the International Paint Corporation and consists mainly of asphaltum heavily loaded with oils which protect the metal; in addition to these hydrocarbons, there is incorporated in the mixture a great deal of sawdust. When applied to the interior of the body, this material becomes tacky in a few minutes, but never gets really hard. The full deadening effect is not obtained until 24 hours after application.

Self-Fluxing Brazing Rods

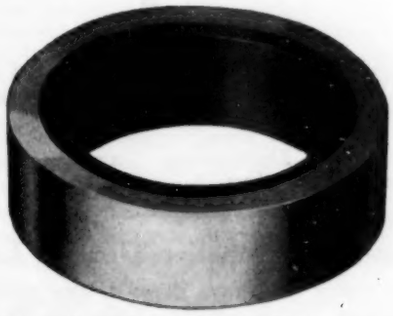
A new type of brazing material has been developed and is being patented by Krembs and Company, 669 West Ohio street, Chicago, Ill. This material, known as "Nu-Art" self-fluxing brazing rods, for use where silver solder of other strong brazing material is generally required. The makers state that in a recent practical application by a firm manufacturing a nickel silver product, the new type of brazing material produced a seam which after polishing was not discernible from the rest of the metal. It is claimed that common brass, bronze, rich-low-brass, copper, extruded bronze, and extruded nickel silver can be brazed easily and safely with this material. Joints produced are stated to be as strong as the metal joined and the metals joined can be matched in color by the braze.

This company has been manufacturing fluxes for brazing, welding and soldering since 1895, it is stated. The line of products includes a variety of compounds under the trade name "Fluxine," which includes a standard brazing compound, flux for silver solder, special welding and brazing compound, and compounds for welding cast iron, tobin bronze to cast iron, steel to steel, sheet aluminum, nickel alloys to iron, cast aluminum, stainless steel to other materials, etc. The company gives an impressive list of users of its products.

New Bi-Metal Bearing

Seeking to produce a more satisfactory bearing metal at a lower cost, engineers of the Frederickson Company, manufacturers of bearing metal, in Saginaw, Michigan, have developed a new type of bi-metal bearing which is said to possess many unusual advantages. The Company has for a number of years been manufacturing bearing bronze sold under the trade name of "SABECO," which, as described by an official of the company, is composed of virgin copper, tin, and lead—with a high percentage of lead alloyed by a secret process said to prevent segregation of the lead as well as seizing, scoring, burning, corrosion, pounding out, and many of the other evils associated more or less with bronze bearings. It is said to possess unusually long life and a low-coefficient of friction and to require less lubrication than ordinary bronzes.

The cost of manufacture under the secret process, however, has precluded its use in many instances where its advantages were very desirable. Experiments to overcome this condition were responsible for the new bearing material which is to be known as "SABECO-ED STEEL BEARINGS." It consists of an outer shell of seamless steel tubing to which an inner lining of "SABECO" bearing bronze is inseparably fused. Tests of the fusion of the metals have been made by bringing the entire bearing to the melting point of the bronze, allowing it to run out. Examination after cooling showed a film of the bronze adhering to



New Type Bearing, Showing Bi-Metal Construction

the steel. Fusion is shown in machining, there being no separation of the metals in the chips, the makers state.

A very unique patented process of manufacture was developed after numerous experiments, the bearing metal being deposited on the steel shell by centrifugal force while the temperature of both metals is at the melting point of the bronze. This process, in addition to bringing about perfect fusion of the two metals, produces a uniform inner shell of the bearing material which is very quickly and easily reamed to the desired size, it is stated.

An important claim made for the new bearing material is that it possesses a lower co-efficient of expansion, permitting a closer fit and adding to the life and wearing qualities. In spite of its numerous advantages, the cost of the manufacture is said to be about the same, and in many cases less than that of ordinary bronze. At present the construction cannot be practically applied to bearings with very thin walls; the minimum wall thickness in which it can be used in about one-eighth inch. The new material can, however, be furnished in lengths up to many feet, thus affecting an important economy in production work as pieces to the exact size required may be cut off with minimum waste.

Salve for Chromium Sores

The E. Wambaugh Company, Goshen, Indiana, manufacturers of chemical specialties for electroplating, have just added to their line of products a newly developed healing agent for sores caused by contact with chromium plating solutions and fumes from such solutions. This is being marketed under the trade name of "Chrome Salve" and is for direct application to affected parts. The salve is also for use in prevention of injury to nasal tissues of chromium platers. Complete directions are furnished with the salve. It is packed in three-ounce jars.

Solution Temperature Regulator

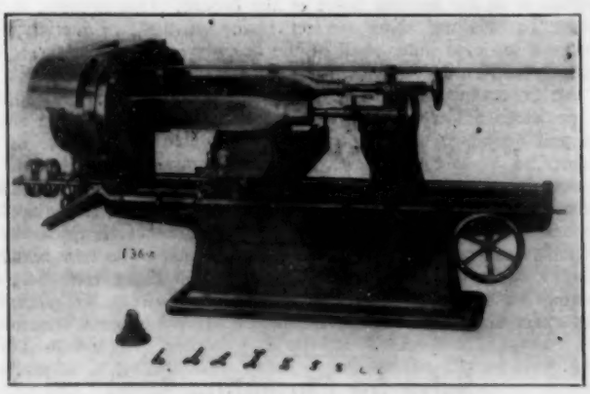
The Bristol Company of Waterbury, Conn., has developed a temperature controller for use in chromium plating solutions, which it is stated can hold these solutions within a range of 1° F.

Temperature Regulator for Chromium Plating Baths

The device is said to be simple and rugged, and operable for twenty-four hours a day. Installations have been placed in the plating plants of the Chevrolet Motor Company, Olds Motor Company, Grand Rapids Brass Company, Dunn Steel Products Company, Enterprise Electroplating Company, Hancock Manufacturing Company and others.

Aluminum Propeller Turning Lathe

The accompanying illustration shows a lathe designed by the Defiance Machine Works, Defiance, Ohio, for the purpose of turning down aluminum propellers for airplanes. It is known as the "Defiance No. 613 Aeroplane Aluminum Propeller Turning Lathe," and has been especially designed for turning the flat winding portion of aluminum alloy propellers or wood blade propellers and struts as used on the various types of aircraft, although the machine can be used for the production of other irregular



Lathe for Turning Aluminum Propeller Blades

shaped articles of varying lengths up to 5 feet and widths or diameters up to 12 inches. The machine is the latest adaptation of the well-known Defiance copying lathe which produces facsimiles of the models used, producing both right and left hand pieces from the same model. By a simple adjustment of the machine, either end of the work or the entire piece can be made larger or smaller than the model to suit requirements.

The screw feeding mechanism, which controls the cutterhead carriage, feeds from right to left or alternately from left to right, or can be used to feed in one direction only. It has five changes of feed from ⅛-inch to ⅜-inch, varying 1/16-inch to each revolution of the work being done. It can be started or stopped instantly at any position of the cut. At the lowest rate of feed, it will turn 2½ inches per minute and at the fastest rate 13 inches per minute.

When turning aluminum alloy, a 12-inch diameter, 1⅛-inch circle nose special tooth milling cutter is used, which is mounted on sliding frame and supported by substantial carriage which travels across the path of the material to be turned by means of a heavy feed screw driven by double friction pulleys, operated by convenient hand lever for starting feed which is automatically disengaged when the end of the cut is reached.

A hollow chuck is supplied on both pattern and turning sides of the machine for holding single blade propellers and driving. At the tail stock end, the propeller is held with center provided with ball-bearing thrusts.

Machine, as regularly furnished, is supplied with one milling cutter with tracing roll to suit, and with necessary oil cups and wrenches.

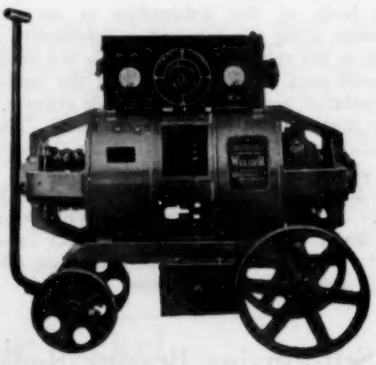
The counter is furnished as follows: Shaft 2-3/16 inches by 13 feet long; 3 No. 3 Hyatt roller bearing equipped drop hangers; with rack and pinion belt shifting apparatus; one two-step cone pulley 4 inches by 6 inches by 2⅛ inches face; one sectional drum for driving cutterheads 16 inches by 77 inches; feed pulley 3 inches by 2 inches; tight and loose pulleys 12 inches by 4 inches; speed 600 r.p.m.

Floor space occupied, 120 inches by 76 inches; export shipping weight, 5,400 lbs.; net weight, 4,260 lbs.; cubic measurement, 337 cubic feet; domestic shipping weight, 5,050 lbs.

Portable Arc Welding Equipment

The Hobart "Constant Arc" welder with "Unitrol" dial is offered by Hobart Brothers, Troy, Ohio, manufacturers of motor-generators, welders and other equipment. The company claims the following advantages for the "Constant Arc" welder shown in the illustration.

Laminated internally with all steel frame electrically welded.



Portable Arc Welder

Insures far better magnetic qualities for the motor-generator with less weight and bulk.

Hobart "Unitrol" dial gives complete welding range for all kinds of work, indicating proper adjustment of the convenient rheostat handle as well as the correct size of electrode to use for any thickness of metal. Centralized controls, protected by sturdy steel cabinet mounted on top of outfit where it is safe from sideswiping and convenient for operator. No knife switches to manipulate.

Separate ammeter and voltmeter, accurate and plainly marked, located on front of panel where operator can see them to check amperage or voltage at any time without leaving his work to operate a switch.

Hobart reactance unit and internal windings, with laminated pole pieces and inter-poles. Substantial brush holders with ample brush capacity.

Internal exciter construction eliminating necessity for separate

exciter, making possible the more compact design of welder and, with the ball bearings, insuring economy of operation of the apparatus.

Compact, single unit design with narrow tread wheels and with front wheels designed to turn under the truck.

Complete equipment is furnished with the welder, as follows: arc-proof hood shield, with glass; electrode holder with 5-foot extra-flexible cable and connector; flexible 25-foot welding cable; flexible ground cable, 25-foot; ground plate; curved back wire cleaning brush; a variety of welding rods; six carbon welding electrodes; set of operating instructions.

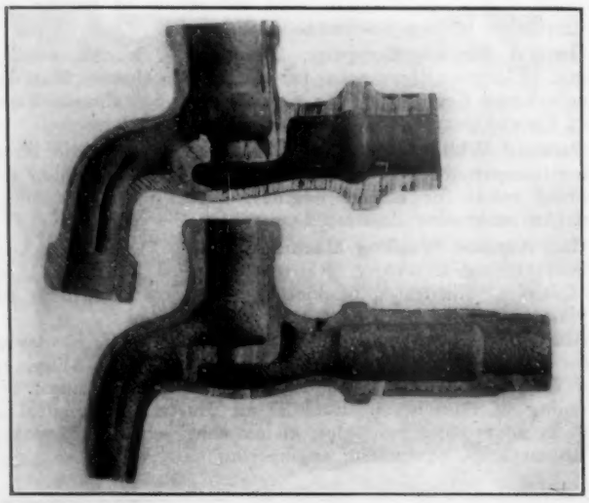
The wheels of the welder are roller bearing, with grease cup lubrication.

The welder is made in two sizes; 10 horsepower, 1800 revolutions per minute, 200 amperes; and 15 horsepower, 1,800 r.p.m., 300 amperes.

New Core Treatment Method

A new method of treating cores and molds in the production of castings, discovered by The Sherman Corporation, Boston, Mass., industrial engineers, and now being developed in the foundries of several of its clients, has produced some interesting results, the Sherman Company reports. Describing the method, they state the following:

The method uses a highly volatile liquid vehicle diluted with various soluble binders to stiffen the surface filler material, preferably red talc, and the coating may be applied in varying thicknesses, due to infiltration; it dries quickly and is non-inflammable.



Inner Surfaces of Castings, Upper Made with Treated Core, Lower with Untreated Core

Thus far the method has been used largely on dry sand cores and molds, and with cores having either gluten or oil binder, or a combination of oil and other binders, and the method is said to be particularly useful in brass foundries, due to the metal cutting into cores and molds.

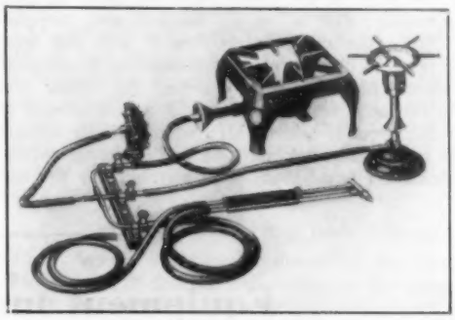
Demonstration has indicated that the work of cleaning castings, through this core treatment, is reduced materially—running from 15 to 25% less.

The treated cores and molds do not absorb moisture and may be stored indefinitely, it is claimed. Sand blasting of all cored work has been reduced to much less than is required without the treatment. Elimination of sand imbedded in the castings of core holes even without sand blasting, and the saving of machine tools have resulted in at least one instance in a 25% increase in cutting speeds and elimination of much of the tool grinding, the Sherman Company declares.

The demonstrations to date, they claim, indicate that this method pays for itself in actual savings, in addition to improving the quality of castings. The illustration shows the difference in inner surfaces of castings that were produced with treated and untreated cores.

Source of Intense Heat for Laboratory Work

Plants maintaining testing laboratories of various sorts do a great deal of their experimental and research work with the aid of small flame apparatus in which the flame can be easily controlled and is hot enough to melt various metals. A convenient and complete laboratory installation consists of a small tank of dissolved acetylene; a hot plate; a Bunsen burner; an acetylene-and-air torch with air control; a reducing valve; a three way branch valve, and the necessary red gum tubing, says the Prest-O-Lite Company, 205 East 42nd Street, New York.



Flame Apparatus for Small Work

With this outfit, it is stated, all manner of laboratory tests can be undertaken. Dissolved acetylene is said to have many distinct advantages over liquid or other gas fuels. It not only produces a higher flame temperature than coal gas or natural gas, but forms a flame that can be perfectly controlled. This flame is non-oxidizing and non-carbonizing as well, it is claimed.

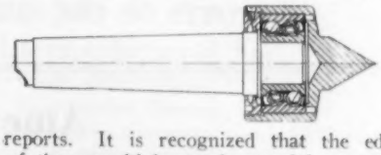
A special type of torch has been developed for test work; it uses compressed air in addition to dissolved acetylene. The flame may be changed from the brush type to an intense needle point by adjusting the air supply by a twist of the adjusting screw. The brush, or bunsen flame, has a temperature of approximately 2,800 degrees Fahrenheit and the needle point flame produces approximately 3,300 degrees Fahrenheit, making it suitable for work requiring high temperatures. A wide latitude of temperature control is possible by adjustment of the gas pressure, providing a range of heat in many metals from near melting up to the molten stage.

The hot plate and bunsen burner recommend themselves by their convenience, cleanliness and intensity of the flame. They save time and keep instruments and utensils free from soot and smoke, it is stated.

New Ball Bearing Live Center

The greatly increased speeds at which metal removing machines now operate in order to take full advantage of the new cutting tool materials have practically necessitated the use of anti-friction bearings in the work centering devices of many types of machines. A ball-bearing tailstock live center placed on the market by the Ready Tool Company, Bridgeport, Conn., has met all of the requirements of such a device with especially fine results, the company reports. It is recognized that the edges of cutting tools made of the new high speed materials are very sensitive to any chatter or vibration, and the success of this live center is due to the extremely rigid and non-deflecting support which it provides for the work, according to the manufacturer.

Ball Bearing Live Center



Rigid and extremely accurate support under all load and speed conditions is said to be made possible by the design of the "New Departure" double row bearing employed. This angular contact bearing has solid, high carbon chrome steel inner and outer races and is so assembled that the two rows of balls are opposed in a definitely preloaded condition. It claimed that when work is supported by this bearing, not only is chatter reduced and cleaner cutting obtained, but edges of cutting tools stand up much longer than with dead centers which cannot be tightly adjusted to the work.

In this design, when the center is set up, the work is brought

close to the tailstock proper, so that the inherent rigidity of the bearing is not offset by deflection of other parts, which would result where there is considerable overhang, it is stated. Another feature claimed is that the housing closure or seal, being located on the side opposite the work, is therefore protected from direct force of the cutting compound; also, that the rotating housing helps to keep lubricant in, but throws compound and chips away from the bearing seal. In this center, the "New Departure" ball-bearing is so mounted that the outer race rotates with the nose of the center, and the nose, or point, is ground after assembly; that is, on the bearing, and, therefore, runs dead true. Since the center nose rotates with the work, regrinding of the nose is infrequently required, but if necessary may be readily accomplished without removing the center from the machine, since the nose may be driven by a belt around the bearing housing, while a cut is taken with a small grinder adjusted to the angle of the point. The bearing used in this center requires no attention to lubrication or adjustment of any kind by the user, it is stated. It is now manufactured in the most used taper sizes, but tapers of any type or size can be made to order, the manufacturer states.

Films Tell Story of Monel Metal

A two-reel motion picture telling the story of Monel metal has been released by the Rothacker Film Corporation, Chicago, Ill., the International Nickel Company announces. The film shows the preparation of the metal in its various commercial forms at Huntington, West Virginia, and traces its various uses in more than a score of industries. Also shown in the film is the tapping of an eleven ton furnace with the molten metal being poured at a temperature of 3000 degrees Fahrenheit. This is the largest nonferrous electric furnace in the world. The picture is being offered to schools, societies, commercial organizations, and the like without charge and is available in 35mm and 16mm widths.

Equipment and Supply Catalogs

Tool and Cutter Grinding Machines. Norton Company, Worcester, Mass. Illustrated catalog of special grinding equipment.

Standardized Drive for Bucket Elevators. Link-Belt Company, Chicago, Ill. No. 1086, a booklet on Caldwell Standardized Drives.

The Baird Machine Company, Bridgeport, Conn. Leaflet on wire and ribbon metal forming machinery, grinders, oblique tilting tumbler barrel, etc.

American Roller Bearings. American Roller Bearing Company, Pittsburgh, Pa. Illustrated, looseleaf catalog, giving data and dimensions, applications, etc.

Precision Through Optical Methods. Bausch and Lomb Optical Company, Rochester, N. Y. Booklet on some newly developed optical devices for machine shops, etc.

Grinding of Cemented Tungsten Carbide. Norton Company, Worcester, Mass. Interesting 28-page booklet on methods of grinding the new cutting-tool metal introduced last year.

"A. W. P." Welds Under the Microscope. Alloy Welding Processes, Ltd., Ferry Lane Works, Forest Road, London, E. 17, England. Bulletin 62, an illustrated pamphlet on welding.

Practical Plating Pointers. The Meaker Company, 1615 South 55th Avenue, Chicago, Ill. A handbook for electroplaters, covering cleaning and finishing of metals and a good variety of other technical data.

Amsler Hydraulic vs. Lever Type Testing Machines. Herman A. Holz, 167 East 33rd Street, New York City. Discussion of the accuracy of load indications of tension and compression testing machines.

General Electric Company, Schenectady, N. Y., publications: Electric Equipment for Handling Heavy Material; Single-Stage Centrifugal Air Compressors for Cupola Blowing; Quiet-Operating Induction Motors.

Parsons' White Brass S. A. Cramp Brass and Iron Foundries Company, Philadelphia, Pa. Bulletin 10, describing this bearing metal for marine engines, Diesel motors, turbines, etc. An interesting illustrated pamphlet.

Colt Autosan Washing Machines. Colt's Patent Fire Arms Manufacturing Company, Autosan Machine Division, Hartford, Conn. Illustrated booklet on metal parts cleaning and drying machines of standard and special design.

Aluminum Company of America, Pittsburgh, Pa., has issued three new booklets as follows: The Riveting of Aluminum and Its Alloys; Screw Machine Products of Aluminum; The Welding of Aluminum. Each is an illustrated technical as well as advertising pamphlet, giving considerable information as to methods, equipment, engineering data, etc.

Associations and Societies

REPORTS OF THE CURRENT PROCEEDINGS OF THE VARIOUS ORGANIZATIONS

American Electroplaters' Society

HEADQUARTERS, CARE OF GEORGE GEHLING, 5001 EDMUND STREET, PHILADELPHIA, PA.

Conference on Research, March 22, at Rochester

Rochester Branch Annual Banquet

The Rochester Branch of the American Electroplaters' Society will hold its annual educational session and banquet on Saturday, March 22, at the Powers Hotel, Rochester, N. Y. In conjunction with this meeting, the Research Committee of the Society will hold a conference and the research associates who have been maintained at the Bureau of Standards, Washington, D. C., to work on problems in electroplating, will present papers indicating their results during the past year.

The Society is now engaged in the work of raising subscriptions among the manufacturers and the Branches of his Society to support another three years of research work. Those who attend the Rochester meeting in March will have an opportunity of judging the vast importance of this work to the whole industry. At the conference, which all who are interested in electroplating are urged to attend, the morning session will be devoted to a discussion of important industrial plating problems and the steps being taken toward their solution.

Authorities in their respective fields will represent industries engaged in manufacture of automobiles, accessories, airplanes,

plumbing fixtures, electrical goods, hardware, office and household equipment, silverware, etc. The session will be conducted by S. P. Gartland.

Afternoon Session

At the afternoon session, reports will be presented covering plating research in progress at the Bureau of Standards, various universities, industrial laboratories, etc., and there will be an opportunity to discuss the best means of obtaining funds for conducting the research work of the Society, which has been going on for the past three years with very fine results.

It is hoped that there will be a large and representative attendance. Those planning to come are requested to notify the secretary. Charles Griffin, 24 Garson Avenue, Rochester, N. Y., so that the necessary arrangements can be made. Reservations will be secured at hotels if requested.

Annual Banquet

The eighteenth annual banquet of the branch will be held in the evening of the same day, March 22.

—CHARLES GRIFFIN, Secretary.

Bridgeport Branch

HEADQUARTERS, CARE OF W. H. EHRENCRONA, BOX 301, R. F. D. 1, BRIDGEPORT, CONNECTICUT

The Bridgeport Branch of the American Electroplaters Society held its annual session and banquet on March 8, at the Stratfield Hotel, Bridgeport. A complete report of the session and entertainment will be given in our next issue.

St. Louis Branch

HEADQUARTERS, CARE OF C. T. McGINLEY, 8214 FAIRHAM AVENUE, ST. LOUIS, MO.

Annual Banquet and Session

The seventeenth annual banquet of St. Louis Branch has passed into history, and your humble servant has promised to write up the event for publication. I tried to fudge out of it and Eddie Musick knew doggone well that it would be two or three weeks before I would attend to it, not that it matters much because it's history anyway and history not only improves with age but grows in the telling.

Now to recount this banquet happening. It took place on January 25th at the Hotel Chase, there being an afternoon educational session and a banquet and dance in the evening. Seventy-five platers and guests were present in the afternoon and 250 guests in the evening.

Herb Williams generally presides in the afternoon session. Herb is good at it but this time he had a cold and wished the job on to me. I must be slipping because I used to be quite good at evading work; besides, my efficiency wanes rapidly late in the afternoon as I begin to get hungry. I can shine at a banquet because when I am well fed I become quite intelligent. I can describe it like this:

At plating dope elucidation,
Using no prevarication
And disclaiming ostentation,
I admit that I am good;
But it really is quite rummy
When there's nothing in my tummy,—
I'm as dumb as any mummy
When I'm waiting for my food.
My intelligence just oozes
And my brain to work refuses,
All efficiency it loses,
When my innards lack for grub;
But when with food I've stocked 'er
I know more than any doctor,
Even more than Charley Proctor,—
But, when hungry, I'm a dub.

However, the afternoon session was enjoyed by all present. The principal speakers were:

Jacob Hay, plating superintendent of the Hall Lamp Company, Detroit, a practical plater of varied and large experience. He read two interesting papers which were given the closest attention and enjoyed by all present. The first was on modern methods of cleaning metals for chrome plating, and the second covered the subject of plating generally in a masterly way.

Dr. Stout of Washington University next spoke; his subject being the merits and failures of chromium deposits. Dr. Stout has done considerable work on chrome deposition and his talk was of the keenest interest.

Charles Proctor, founder of the Society, then addressed the meeting. Charley always has something interesting in the plating development line to speak about. **Ed Heil** of Wichita also contributed to the success of the afternoon. I don't remember what Ed spoke about; my memory is weakening.

Ernie Lamoureaux and **Fred Liscomb,** who both were active in the information of the St. Louis Branch, were absent for the first time since these annual banquets were started. We missed both of them.

The banquet and dance was a great success. The attendance of 250 was slightly less than at the previous banquet but in enthusiasm and enjoyment, it was the best banquet St. Louis Branch ever had. Special thanks are due to Eddie Musick, who always does the lion's share of the work, although such a description appears to be a misnomer. I never heard of lions doing any work. Perhaps I should have said that Eddie did the horse's share of the work.

Airplane Party from Chicago

The Chandeysson Electric Company, St. Louis, as usual contributed a great deal to the success of the event. They provided seventy-six guests of their own, twenty-six of whom were from

The Airplane Party to the St. Louis Banquet

other cities. There were fourteen from Chicago, Detroit and Milwaukee who met at Chicago and were brought to St. Louis by airplane (see photo). Another plane brought a party of six of the Chandeysson guests from LaSalle and Peru, Ill. On the return trip on Sunday a couple more were added to the airplane party, namely, Mr. Hayes of Detroit and Mr. Lockerbie of Goshen, Ind. The parties were made up as follows: Detroit: G. L. Nankervis, Mr. and Mrs. M. M. Wise, Mr. and Mrs. Z. A. Reader, Mr. and Mrs. F. Helrigel, Chicago: Mr. and Mrs. S. E. Huenerfauth of Crown Rheostat and Supply Company, and G. E. Huenerfauth, of the same company; R. C. Trees, Mr. and Mrs. G. A. Spencer. Milwaukee: Mr. and Mrs. A. J. Donald.

Location of Banquet Changed

The change of location from the American Hotel to the Chase Hotel was approved by all; even the weather man helped, giving us mild weather.

HEDLEY J. RICHARDS.

American Electrochemical Society

HEADQUARTERS, COLUMBIA UNIVERSITY, NEW YORK CITY

New York Section Meeting

Dr. Francis C. Frary, Director of Research, Aluminum Company of America, and National President of the American Electrochemical Society, was the speaker at the joint meeting in the Chemists' Club, 52 East 41st Street, New York City, February 14, of the New York sections of the various chemical societies. His talk, "Present-Day Aspects of the Aluminum Industry," was supplemented by some interesting demonstrations of the characteristics of aluminum and its alloys, particularly in relation to the remarkable results that have been obtained through new methods of heat treatment that have recently been developed.

Annual Convention in May

The annual convention of the Society will take place May 29 to 31, inclusive, at the Coronado Hotel, St. Louis, Mo. The St. Louis Committee, headed by Carl Hambuechen, is planning a very

elaborate program of industrial trips and social entertainment for the visiting members and guests.

Sessions are being planned and the tentative schedule provides for the opening session to be devoted to electrode position, in charge of Dr. C. L. Mantel. Other sessions are also planned covering various fields of electrochemistry.

Manuscripts for papers to be read at this meeting should be in the Secretary's office, Columbia University, New York City, prior to March 15.

Traveling arrangements, including an air-rail route, can be discussed with the secretary.

Materials Testing Society

HEADQUARTERS, 1315 SPRUCE STREET, PHILADELPHIA, PA.

At a regional meeting sponsored by the American Society for Testing Materials, to be held at the Book-Cadillac Hotel in Detroit on March 19, special emphasis will be given to a discussion of automotive materials. Arrangements have been made for a "Symposium on Developments in Automotive Materials." Twelve formal papers will be presented as indicated in the enclosed program which should serve to bring about considerable discussion of the several topics and thus make available much data of interest and value. In addition to the A. S. T. M. membership, the members of the local chapters of the Society of Automotive Engineers, the American Society for Steel Treating and the National Association of Purchasing Agents are participating.

The papers are being preprinted for distribution at the meeting and also in advance of the meeting to those requesting copies.

The technical sessions will be followed by an informal dinner after which there will be a demonstration of audible light through the courtesy of the Research Laboratory of the General Electric Company, the demonstration to be given by John Bellamy Taylor of that organization. F. O. Clements, Technical Director of the Research Laboratories of the General Motors Corporation, who is Vice-President of the A. S. T. M., is chairman of the Committee on Arrangements.

Aluminum Research Institute

HEADQUARTERS, 308 WEST WASHINGTON STREET, CHICAGO, ILLINOIS

The following is the text of specifications for the purchase of aluminum scrap adopted by the membership of the Aluminum Research Institute at a recent meeting:

Scrap Aluminum Castings: Shall consist of clean, heavy automobile castings, containing not more than 12% industrial mixed castings both of which must be free from die cast aluminum, pistons, pattern metal and hat blocks. All of the above material also to be free from iron, babbitt, brass and any other foreign substance. Oil and grease must not exceed 2%.

Scrap Sheet Aluminum: Shall consist of clean, old, unalloyed sheet aluminum, guaranteed free from iron, dirt and all foreign metals and substances.

Painted Scrap Sheet Aluminum: Shall consist of clean, old, painted, unalloyed sheet aluminum, guaranteed free from iron, dirt and all foreign metals and substances.

New Aluminum (Pure) Clippings: Shall consist of new, clean, dry, unalloyed aluminum clippings and cuttings, free from punchings and all other foreign materials.

New Aluminum Alloy Clippings: To be handled on specification or sample

Aluminum Pistons: Shall consist of clean aluminum pistons, free from iron and any other foreign substance.

New Aluminum Wire and Cable: Shall consist of new, clean, dry, unalloyed aluminum wire or cable, free from iron, insulation and any other foreign substance.

Old Aluminum Wire and Cable: Shall consist of old, unalloyed aluminum wire or cable, containing not over 1% free oxide or dirt, and free from iron, insulation and any other foreign substance.

Aluminum Borings: To be handled on specification or sample.

Aluminum Drosses: To be handled on specification or sample.

Aluminum Grindings, Sawings and Sweepings: To be handled on specification or sample.

Aluminum Spatters: To be handled on specification or sample.

Aluminum Spinnings: To be handled on specification or sample.

Aluminum Foil: To be handled on specification or sample.

The Aluminum Research Institute was organized several months ago by the major secondary aluminum smelters. The object of the organization is to improve and develop the business of manufacturing aluminum alloys and to endeavor to solve the problems which arise in connection with raw materials and with the making and distributing of aluminum alloys. Obviously, the attainment of such obectives must be accompanied by definite efforts to promote a high standard of business ethics in the industry and to aid in establishing equitable principles among the smelters and their customers. The Institute is making satisfactory progress toward these objectives. The adoption of the purchase specifications quoted above illustrates the constructive nature and the logical order in which the Institute's work is being undertaken.

Institute of White Metals

HEADQUARTERS, SUITE 1258, 11 WEST 42ND STREET, NEW YORK CITY

The Institute of White Metals was organized at a meeting of custom smelters and manufacturers of white metals at the Astor Hotel, Friday, February 14. Smelters and manufacturers from Chicago, Indianapolis, New York, Boston, Buffalo, Newark, Philadelphia, Pittsburgh, Norfolk, and Toronto, Canada were represented.

L. Muscat United American Metals Corporation, Brooklyn, N. Y., was elected temporary chairman, with Walter Schoenbach, American Lead Company, Indianapolis, Inc., temporary secretary, and Jerry Katz, American Metal Company, New York City, temporary treasurer. It was decided to call a meeting at Chicago of smelters and manufacturers of white metals in the Middle West, on March 7, for the purpose of enrolling the mid-western sections. At a meeting following the Chicago conference, permanent officers will be elected.

Benjamin Schwartz, director general of the Institute of Scrap Iron and Steel, Inc., outlined a program of activities for the Institute of White Metals, covering the fields of cooperation, education in costs, establishment of trade practices, public relations, standardization and certification of materials, credit and arbitration. "The main task of your Institute," declared Mr. Schwartz, "will be to secure recognition for the services which you render, and to establish a machinery of enforcement for the high standards of merchandising which should be expected of the Institute."

The report of the Organization Committee, consisting of I. Davis, Jerry Katz, E. C. Miller, L. Muscat, J. H. Paterson, S. Siegel and Walter Schoenbach, contained the following recommendations.

A trade association is essential for the industry, to eliminate unfair trade practices, instill cooperation among the various groups within the industry, establish standardization, protect the credit, and to carry on such other cooperative activities in the best interests of its members.

That immediate steps be taken to incorporate under the laws of the State of New York a membership corporation to be known as Institute of White Metals, Inc.

That an executive or trade association counsel be engaged from outside of the industry.

That the officers shall consist of a president, two vice-presidents, a chairman of the executive board, a treasurer and a secretary, who shall serve without compensation.

That the governing body shall consist of an executive board of fifteen, including the officers.

That charter membership shall be open to a selected group of smelters and manufacturers, including custom smelters, solder manufacturers, babbitt manufacturers and type metal manufacturers. It is the consensus of opinion of the committee that plans for expanding the membership should be reserved for the consideration of the executive board of the Institute.

That the annual membership dues should be $200 per year, it being understood that special group activities may require special appropriations for the members of the groups.

That the executive board of the Institute shall meet as soon as possible after its election, to engage a trade relations counsel and draw up a set of by-laws for the Institute, to be submitted to the general membership at the next meeting.

—BENJAMIN SCHWARTZ.

Metal Findings Manufacturers

HEADQUARTERS, CARE OF H. R. BARKER, FULFORD MANUFACTURING COMPANY, PROVIDENCE, R. I.

The Metal Finding Manufacturers' Association, which was organized some months ago, has commenced an intensive campaign to eliminate a number of the trade abuses that have been the bane of the metal findings industry for a number of years. Culminating six months of intensive investigation, study and deliberation, a code of ethics far-reaching in scope and designed to wipe out unfair trade practices has been adopted and at the meeting in March the special feature will be the consideration of the report of the credit committee relative to this phase of the industry.

Declaring that the success of the industry depends on the maintenance of equitable conditions the association in its code suggests ten rules for the improvement of present business practices. It also outlines eight fundamentals that are considered essential to the proper and definite conditions of sale and delivery. A definite stand is also taken against discrimination in prices, discounts or terms, piracy of designs and violation of sales contracts. The code was adopted by all the concerns present and has received the indorsement of other member firms that were not in attendance.—W. H. M.

British Institute of Metals

HEADQUARTERS, 36 VICTORIA STREET, LONDON, S.W.1, ENGLAND

Annual General Meeting

The annual general meeting of the Institute of Metals of Great Britain is being held March 12 and 13, just as we go to press. A list of the papers being delivered at the meeting follows:

Experiments on the Influence of Gases on the Soundness of Copper Ingots. N. P. Allen.

Unsoundness in Bronze Castings. E J. Daniels.

Gases in Copper and Their Removal. W. E. Prytherch.

Protective Value of Some Electro-Deposited Coatings. L. Davies and L. Wright.

The Diffusion of Zinc in Copper Crystals. C. E. Elam.

Macrostructure of Cast Alloys. Effect of Turbulence Due to Gases. R. Genders.

The Aluminium-Brasses. R. Genders.

Atmospheric Action in Relation to Fatigue in Lead. Prof. B. P. Haigh and B. Jones.

Investigation of the Effects of Impurities in Copper. Part VI—The Effect of Phosphorus in Copper. D. Hanson, S. L. Archbutt, Grace W. Ford.

A Note on Metallic Magnesium. W. R. D. Jones.

A Note on Zinc-Base Die-Casting Alloys. R. Lancaster and J. G. Berry.

The Early Use of Metals. T. A. Rickard.

The Composition of Eutectics. D. Stockdale.

Annual May Lecture

This year's Annual May Lecture of the Institute of Metals will be delivered by Major F. A. Freeth, Research Manager, Imperial Chemical Industries Limited, on **"The Influence of Technique on Research."**

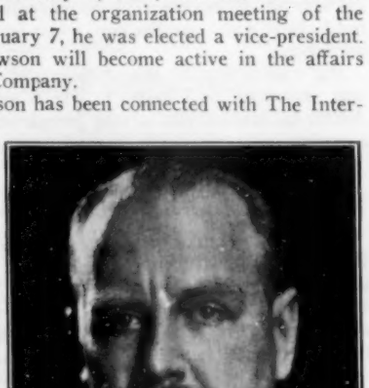
In September the Institute will visit Southampton for the purpose of holding the annual Autumn meeting.

Personals

William B. Lawson

At the annual meeting of the Harshaw Chemical Company, Cleveland, Ohio, held on February 6, 1930, William B. Lawson was elected a director, and at the organization meeting of the board of directors held February 7, he was elected a vice-president. Beginning at once, Mr. Lawson will become active in the affairs of the Harshaw Chemical Company.

For many years Mr. Lawson has been connected with The International Nickel Company, with headquarters at the executive offices, New York City. Prior to the merger of International Nickel and The Mond Nickel Company, Ltd., with general offices in London, England, and mines and works in both Canada and Great Britain, he was general manager of sales of The International Nickel Company, and on completion of the merger, he became director of sales of The International Nickel Company of Canada, Ltd., which is the parent company of the merged enterprise. Mr. Lawson resigns as director of sales of The International Nickel Company of Canada, Ltd., and from the boards of various owned and associated companies in the United States and Europe, to join the Harshaw company.



William B. Lawson

Mr. Lawson brings to the Harshaw Chemical Company the experience of 25 years connection with the Nickel company, during which he has become well known in the metal and chemical industries generally, both in the United States and Europe. He has made an enviable record in connection with the affairs of The International Nickel Company.

Thomas A. Gardner, of Hackensack, N. J., has taken a position as foreman electroplater with the Hobson Flatware Company, Lambertville, N. J.

August M. Brandt, who recently resigned from Chase Companies, Inc., after eighteen years of service, has joined the engineering staff of J. H. Roberts and Associates, 27 West Main Street, Waterbury, Conn., consulting engineers.

Miss A. F. King, for the past ten years general manager of Victor A. Picard and Company, has established her own manufacturing business, King's Enamel and Silverware, Inc, 7-11 West 45th Street, New York City. The firm will specialize in manufacture of hand made enameled sterling silver and gold boudoir sets in distinctive designs.

Emil Hass has joined The J. B. Ford Sales Company, Wyandotte, Mich., as a sales representative and is connected with the company's New York City office at 9 Park Place. Mr. Haas is well known in the plating trades, having formerly been a foreman plater. The Ford company manufactures the widely known "Wyandotte" brand cleaners for metals, etc.

Thomas H. Beaulac, formerly with the Worthington Pump and Machinery Corporation, Harrison, N. J., is now in charge of the brass and iron foundry division of the Springer Lock Manufacturing Company, Ltd., Belleville, Ont., Canada. Mr. Beaulac was with the Franklin Foundry Company, Franklin, Pa, before he went with the Worthington company. He has been at Belleville since last October.

C. W. McKinley has been appointed assistant chief engineer of the experimental engineering department of the AC Spark Plug Company, Flint, Mich., according to a company announcement. Mr. McKinley will retain his duties as engineer in charge of the AC oil filter division. He formerly was chief engineer of the Willys Overland company, and has been with the AC company for the past five years.

William H. Bassett, Jr., has resigned from the American Brass Company, Waterbury, Conn., to become technical superintendent and metallurgist for the Anaconda Wire and Cable Company, Hastings-on-the-Hudson, N. Y. Mr. Bassett writes that the main research and testing laboratories of the company are being developed at the Hastings plant, which makes all types of copper and copper alloy wire and cable.

Obituaries

Warren Phelps King

As briefly stated in our previous issue, Warren Phelps King, 64, a vice-president of the Aluminum Company of America, Pittsburgh, Pa., died suddenly of a heart attack in Sarasota, Florida, January 15, 1930. He was born in Ithaca, N. Y., September 9, 1865, and was a member of the class of 1888 at Cornell University.

Warren Phelps King

His first business connections were with the Lehigh Valley Coal Company, Buffalo, N. Y. Later, he was associated with the New York Car Wheel Company as assistant to the president. About 1907, he bought into the Brooks Brothers Brass Foundry Company. In a short time this company was reorganized and became the Liberty Brass Foundry Company, of which he was made president. In 1910, the Liberty Brass Foundry Company merged with the Allyne Brass Foundry Company and others, to form the Aluminum Castings Company. Of the merged companies, he became vice-president in charge of sales. The Auminum Castings Company was reorganized in November, 1919, into the Aluminum Manufacturers, Inc., with the late Mr. King first as vice-president and then as president.

Warren Phelps King was a large factor in the inception and development of the casting of aluminum under gravity pressure in metallic molds in America, a process which now is used extensively in the making of aluminum castings. He also recognized the suitability of this method for the making of aluminum alloy piston castings, and it was largely a result of his initiative that this product and process were developed.

Of late years his interests had broadened continually. At the time of his death he was a vice-president of the Aluminum Company of America, president of Aluminum Manufactures, Inc., and a director in several other companies.

In 1892, he married Justine A. McKenna, of Buffalo, who survives him, as does a son, Warren Griffin King, and a daughter, Mrs. Richard C. Lux.

He lived in Kirtland, Ohio, near Cleveland, and was a member of the Buffalo and Saturn Clubs, Buffalo, and of the Union, Kirtland Country and Country Clubs, Cleveland.

William H. Nichols

William H. Nichols, chairman of the board of the Allied Chemical and Dye Corporation, died on Friday, February 21st, in the Royal Honolulu Hotel, Honolulu, Hawaii, of heart disease after an illness of two weeks. Mr. Nichols, whose home was in New York, was 77 years old.

Mr. Nichols, who was a leading figure in the chemical industry of the United States, was at one time the head of the Nichols Copper Company, copper refiners, at Long Island City. He built this company up to be one of the largest refineries in the world. He was internationally known as a manufacturer, financier and philanthropist.

Ralph H. Smith

Ralph Herbert Smith, 62, president and treasurer of Smith and Griggs Manufacturing Co., and president and treasurer of the Waterbury Button Company, died at his home in Waterbury, Conn., on February 12, 1930. He was also president of the Randolph-Clowes Company until it was sold to the American Brass Company last year; a director of the Waterbury Buckle Company, the Waterbury National Bank, and of the West Side Savings Bank. He was a member of the University Club of New York, the Farmington Country Club, the Watertown Riding and Country Clubs, of those towns, and the Home Club, Country Club and Waterbury Club, Waterbury.

Mr. Smith was born in Waterbury on October 25, 1867, the son of J. Edward Smith, who played a prominent part in founding the companies with which the deceased was connected. As a young man entered the office of the Smith and Griggs Company, of which his father was president, and was there 40 years. He then became connected with the Waterbury Button Company and, to a lesser extent, with the other concerns.

He is survived by his wife, Mrs. Sarah Miller Smith, whom he married in 1906; one sister, Mrs. Carl E. Munger; a sister-in-law, Mrs. J. Richard Smith; and a number of nephews and nieces, including Mrs. Leavenworth Sperry, Mrs. Wilbur P. Bryan, Mrs. Warren Kaynor, Ralph Smith Munger and Walter S. Munger. The burial was in Waterbury. W. R. B.

William J. McConnell

William J. McConnell, consulting manager of the plating division of the Singer Manufacturing Company, Elizabeth, N. J., died at his home in that city on February 3, 1930, after a week's illness.

Mr. McConnell was born in New York City and went with the Singer company when its plant was in New York, in 1871. He entered the polishing and plating department. When the firm moved to Elizabeth in 1872, he went along and gradually worked his way up to manager of his department, which position he held until about eight months ago, when he was advanced to consulting manager.

He was active in many civic and religious organizations and was prominent in Elizabeth. He is survived by his widow, Mrs. Agnes C. McConnell; a son, Joseph D.; seven grandchildren, and a sister.

Robert E. Hanke

Robert E. Hanke, jewelry manufacturer, 194 Clifford Street, Providence, R. I., died on February 13, 1930, in his seventy-first year. Mr. Hanke was with the Martin-Copeland Company, Providence, for forty years, having retired last November due to failing health. Before that he was with Hanke and Claflin. He leaves a widow, two sons, a daughter and a sister.

John S. Worth

John S. Worth, proprietor of the National Electro Plating Works, Trenton, N. J., died at his home on the Pennington Road, near Trenton, recently after a lingering illness. He was 58 years old. Besides his wife, he is survived by two sons, his mother and one brother.

—C. A. L.

Robert C. Zannoth

Robert C. Zannoth, president and general manager of the Roberts Brass Company, Milwaukee, Wis., which he founded in 1924, died of heart disease on January 25, 1930. Mr. Zannoth was in his sixty-fourth year.

John Olle

John Olle, president of the Racine Brass and Iron Works, Racine, Wis., died January 28, 1930, in his sixtieth year.

News of the Industry

Industrial and Financial Events

American Non-Ferrous Exports Larger

Reports of the United States Bureau of Foreign and Domestic Commerce, Washington, D. C., on exports of non-ferrous metals from the United States during 1929, shows that there was an increase of 4½ per cent in the value of these commodities sent abroad as compared with 1928. There were, however, decreases in some of the major items on this list, as shown below:

Non-Ferrous Metals Exports, 1929

Metal	1928 Quantity	1928 Value	1929 Quantity	1929 Value
Aluminum	.....	$12,102,402	.....	$11,897,368
Copper	tons 562,509	169,831,379	499,237	183,366,672
Brass and bronze	.....	17,617,879	.....	17,499,337
Lead	tons 122,236	11,856,067	78,849	8,707,316
Nickel	.....	2,040,565	.....	2,462,959
Zinc	.....	4,794,141	.....	3,649,394
Other	.....	7,293,153	.....	8,537,685
Precious metals, jewelry, and plated ware, except gold, and silver in ore, bullion, and coin	.....	4,933,061	.....	4,140,816

Morrison Brass Manufacturing Company

The James Morrison Brass Manufacturing Co., Ltd., of Toronto, Canada, has been sold to Equitable Securities Corporation, Ltd., Montreal and Toronto.

The Morrison company has been in business for over 65 years and manufacturers cast iron, steel and brass valves, brass and bronze for pulp and paper plants, locomotive and marine equipment, power plumbing and heating products, and gages for steam, air and water services.

Aluminum Tariff Reduction

Argument on the tariff question in the United States Senate on February 17 resulted in reduction there of the duties on aluminum, crude and scrap, to 2 cents per pound from the former rate of 5 cents. Plates, sheets, bars and squares were cut from 9 cents to 3½ cents. Duty on household utensils of aluminum was reduced to 25 per cent ad valorem from former rate of 11 cents per pound and 55 per cent ad valorem. The reductions made in the Senate are not final, however.

New Haven Sherardizing Company

Stockholders of The New Haven Sherardizing Company, Hartford, Conn., on February 18, 1930, voted to change the firm's name to The National Sherardizing and Machine Company. The move was made because it was felt the company had outgrown the local implications of the "New Haven" name, since it has long since become a national and even international company, supplying sherardizing equipment and supplies to all parts of the world. The company has plants at Hartford, Conn., and at Akron, Ohio, where machinery is manufactured and also plants for sherardizing, plating, etc., are operated.

Geuder, Paeschke and Frey Company

The Geuder, Paeschke and Frey Company, Milwaukee, Wis., manufacturers of special stamped and drawn sheet metal articles and parts, celebrated its fiftieth birthday with the beginning of 1930. This occasion was officially observed in the form of a Golden Anniversary Banquet at the Wisconsin Club in Milwaukee on January 27.

During the past 50 years the firm's plant and manufacturing equipment has been constantly extended until today, with another recently completed building, the floor space totals 19 acres.

Brass Ingot Orders and Sales

On February 1, 1930, unfilled orders for brass and bronze Ingots and billets on the books of the members of the Non-Ferrous Ingot Metal Institute, Chicago, Ill., amounted to a total of 9,630 net tons according to an announcement of the Institute.

The combined deliveries of brass and bronze ingots and billets by members for the month of January amounted to a total of 6,154 tons.

The Institute reports the average prices per pound received by its membership on commercial grades of the six principal mixtures of ingot brass during the twenty-eight day period ending January 31st, as follows:

	Cents
Commercial 80-10-10 (1% Impurities)	16.523
Commercial 78% Metal	14.763
Commercial 81% Metal	15.03
Commercial 83% Metal	15.272
Commercial 85-5-5-5	15.53
Commercial No. 1 Yellow Brass Ingot	12.315

Copper in Washing Machines

Approximately 6,700,000 electric washing machines are estimated to be in use in American homes, according to data on the washing machine industry just compiled by the Copper and Brass Research Association, New York. This total indicates that about one-third of the 19,000,000 wired homes in the United States include electric washers in their equipment, leaving some 12,000,000 homes as a potential market for new sales. The Association's data discloses that there has been a progressive annual increase in washing machine sales from 554,000 in 1923 to approximately 870,000 in 1929.

On the basis of last year's rate of sales being maintained for the next few years, at least, the Association estimates that there is a potential market for approximately 19,000,000 pounds of copper per year in washing machines featuring copper tanks and other vital parts of copper, brass and bronze, including also copper used in the necessary electrical equipment.

American Brass Company

The following were elected directors of the American Brass Company, Waterbury, Conn., at a recent meeting of stockholders: John D. Ryan, Cornelius F. Kelley, Benjamin B. Thayer, all of New York; John A. Coe, Clifford F. Hollister, Edmund H. Yates, Clark S. Judd and Franklin E. Weaver of this city. The directors are the same as last year with the exception of Mr. Weaver, who was elected to succeed the late Edward L. Frisbie.

Aluminum Company of America

Separation of all public utility holdings of the Aluminum Company of America from the ownership and operation of its manufacturing business was reported last month. Under the plan of the company, its extensive utility holdings will be transferred to the Massena Securities Corporation, formed during September of last year.

United Smelting and Aluminum Company

Samuel J. Weil of New Haven, Conn., has been re-elected president and treasurer of the United Smelting and Aluminum Company, Inc., New Haven. Other officers are: Milton E. Rosenthal, vice-president in charge of sales; Harris Lapides, secretary; Joseph A. Weil, assistant treasurer.

Farrel-Birmingham Company

At the annual meeting of Farrel-Birmingham Company, Inc., Ansonia, Conn., on February 20, Franklin Farrel, Jr., who was formerly vice-president, became chairman of the board, and N. W. Pickering was elected president to succeed Walter Perry.

D. R. Bowen, chief engineer; Carl Hitchcock, formerly assistant secretary; Franklin R. Hoadley, manager of the foundry department; and A. G. Kessler, manager of Buffalo division, were elected vice-presidents.

Officers re-elected were Alton Farrel, treasurer; G. C. Bryant, secretary; F. M. Drew, Jr., and L. K. Blackman, assistant treasurers; and W. B. Marvin, assistant secretary.

Mercy Bullets of Aluminum

A new device for hunting game for scientific purposes, is the "mercy" bullet which consists of a fin-tailed shell of aluminum containing chemicals and a nose tipped with a hypodermic needle. When this bullet strikes an object the needle penetrates the skin, expelling the chemicals, which are such as to render the animal unconscious. The bullet does not enter the body. The animal can be examined during this period of unconsciousness, which lasts about three quarters of an hour, after which it recovers and may run off.

Correction

This section in the February issue carried an item regarding the Allied Industrial Products Company, Chicago, Ill., with the sentence, "The policy of expansion has placed the Allied company in a position to supply users of buffs and wheels with any type of these supplies," etc. This sentence is correct as here given, the word "buffs" having been typographically incorrect in the original appearance.—Ed.

Annual Earnings Reports

Following are reports of net earnings, net income, net profits, etc., of various companies; some reports show assets, working capital, etc. Nets are after depreciation, interest, etc.:

New Jersey Zinc Company, New York City, $9,221,794 for 1929; $2,276,168 final quarter 1929.

Canadian Bronze Company, Ltd., Canada, $471,997 for 1929; current assets Dec. 31, 1929, $1,154,110; liabilities, $278,585; working capital, $875,525.

Fedders Manufacturing Company, Inc., (automobile radiators), $230,628 for 1929.

McCord Radiator and Manufacturing Company and subsidiaries, Detroit, Mich., $618,490 for 1929.

Ohio Brass Company and subsidiaries, $2,823,057 for 1929.

National Lead Company, New York, $10,222,897 for 1929, against $5,872,496 for 1928. Extra $3 dividend declared on common stock. Certain non-recurring profits included in 1929 earnings, due to sale of interest in Williams Harvey and Company, Ltd., England; lending of call money during high-interest period; and sale of a subsidiary at a good price after it had been written off on books as a bad asset.

Federated Metals Corporation, New York, $917,836 for year ended Nov. 30, 1929.

American Solvents and Chemical Corporation, $800,627 for 1929.

Art Metal Works, Inc., $1,002,360 for 1929.

Mueller Brass Company, Port Huron, Mich., $7,290,461 gross business for 1929, a record. Prospects for 1930 reported good, with over $1,000,000 in orders now on books.

General Bronze Corporation and subsidiaries, $1,128,464 for 1929, shown in preliminary report. Billings on completed 1929 contracts were $8,811,149 against $5,279,316 in 1928.

Scovill Manufacturing Company, $4,120,088 for 1929.

Business Reports of The Metal Industry Correspondents

New England States

Waterbury, Connecticut

MARCH 1, 1930.

Officers and directors of the **American Brass Company** were re-elected at the annual meeting last month. They are: President, John A. Coe; executive vice-president, Clifford F. Hollister; executive vice-president, Clark S. Judd; treasurer, Clifford F. Hollister; assistant treasurer, Major W. Judge; assistant treasurer, S. Burnham Terry; secretary, Edmund H. Yates; assistant secretary, Edwin J. Rockwell; directors: John D. Ryan, Cornelius F. Kelley, Benjamin B. Thayer, all of the Anaconda Copper Mining Company, and John A. Coe, Clifford F. Hollister, Edmund H. Yates, Clark S. Judd and Franklin E. Weaver, all of Waterbury.

All last year's officers of the **Scovill Manufacturing Company** were re-elected at the annual meeting last month and, in addition, two officers of the former **Schrader Company,** of Brooklyn, N. Y., recently purchased by the local company, were added to the directorate, **W. T. Hunter** and **Francis T. Ward.** A new body, called an executive committee, was also elected, consisting of E. O. Goss as chairman; J. H. Goss as vice-chairman; C. P. Goss, Jr., L. P. Sperry and W. M. Goss. A dividend of $1 a share was declared on the common stock, payable April 1, the same amount paid the last four quarters.

The Scovill Company's financial report for 1929 showed that $21,147,500 in 5½ per cent debentures was paid for the stock of A. Schrader's Son, Inc., of Brooklyn. The surplus account was increased $625,258, making it now $9,924,893 and the reserve item was increased by $234,000, making it $1,701,326. President E. O. Goss said that the report "reflects a very active business for the first nine months and a very considerable depression during the last three months," adding that "a very substantial improvement in the business of the company and subsidiaries has taken place since Jan. 1, 1930, and that a prosperous year is anticipated. He calls attention to the fact that in the report the annual amount set up for depreciation of land buildings and machinery has now almost completely written off those items from the books. The valuation set up for land, buildings and machinery is $31,591,000, less the reserve for depreciation of $19,027,000, leaving the book value as only $12,563,000. The net gain for the year, after all charges except dividends, was $4,120,000. The dividends paid amounted to $3,495,750. Total assets were set at $35,147,721 after deduction for depreciation.

Chase Companies, Inc., earned $2,750,000 in 1929, it is announced, as compared with $1,584,357 in 1928 and $914,280 in 1927. The local concern was acquired by the **Kennecott Copper Mining Corporation** last year for 253,125 shares of Kennecott stock. The earnings for 1929 are equivalent to $10 a share on the 253,125 shares.

Shipments and bookings of the **American Brass Company** for January are reported to have been 80 per cent of the average monthly rate for 1929.

Officers and directors of the **Plume & Atwood Manufacturing Company** were all re-elected last month. The net earnings for 1929 were $310,766 after payment of all charges and setting up of reserves. Dividends paid were $300,000. The surplus account January 1, 1930, was $1,342,577 compared to $1,331,811 a year ago. Total assets are $2,742,577. There were no accounts payable at the end of the year and the only liabilities, the capital stock of $1,250,000, the surplus of $1,342,577 and a reserve item of $150,000. The amount of $65,847 was written off on the book value of the plant during the year.

David C. Griggs, formerly vice-president and general manager, was elected president of the **Waterbury Farrell Foundry and Machine Company,** succeeding **W. Shirley Fulton,** last month. A new position, that of chairman of the board, was created, and Mr. Fulton elected to it. **Frank L. Squires,** formerly assistant treasurer, was elected treasurer; **William B.**

Pierson was re-elected secretary; and **Zenas Candee** and Richard **Wilcox** were re-elected vice-presidents.

Officers of the **Scovill Manufacturing Company** deny rumors again revived to the effect that negotiations are on for the acquisition of the **Bridgeport Brass Company.**

William H. Bassett, technical superintendent and metallurgist of the **American Brass Company,** was elected president of the American Institute of Mining and Metallurgical Engineers last month. He was awarded the James Douglas medal by the Institute in 1925 for achievements in non-ferrous metallurgy. He delivered a lecture before the Department of Mining and Metallurgy of Columbia University, on recent developments in non-ferrous metallurgy, stressing particularly "Everdur," the new copper-silicon alloy, and beryllium, soon to enter the field of commercial metals.

E. T. Stannard, vice-president of the **Kennecott Copper Corporation,** and **Carl T. Ulrich,** secretary-treasurer of that concern, spoke at the dinner of the **Chase Foremen's Association** last month and extended the greetings of the Kennecott organization.

John A. Coe, president of the **American Brass Company,** stated last month that the outlook in brass and copper sales is very encouraging and that his firm has every reason to believe that customers are not overstocked and that they will soon require quantities of such materials to continue manufacturing operations. At times during the past year the facilities of all its mills have been taxed to make reasonably prompt deliveries, he said.

Salesmen of the **Beardsley and Wolcott Manufacturing Company** held their annual convention here last month, including representatives from New York, Philadelphia, Rochester, Cleveland, Detroit, Chicago, Minneapolis, St. Louis, Louisville, Denver, San Francisco, Portland, Ore., Goshen, Ind., and Toronto, Can.

Eight men, three of them members of a local scrap iron firm, were arrested February 20 on the charge of stealing copper valued at $1,000 from the plant of the **Chase Metal Works.** Much of the copper was found in the cellar of one of the men arrested.

Brass models for window weight models, valued at $1,000, were stolen last month from the **Waterbury Foundry Company.** The thieves were not apprehended.

Officials of the **International Silver Company** deny that the local plant of the company, known as **Rogers and Brother,** and claimed to be the original **Rogers Brothers** plant, will be closed and the business moved to Meriden. It is admitted that several departments will be transferred, but it is claimed the main part of the plant will operate as usual.

The French Manufacturing Company, a subsidiary of the **American Brass Company,** elected officers last month as follows: Chairman of the Board, John A. Coe; president, Fred W. French; vice-president, Leon H. French; secretary and treasurer, Clifford F. Hollister; assistant treasurer, Edwin J. Rockwell; assistant secretary, Harry B. Rathbun; directors, John A. Coe, F. W. French, C. F. Hollister, Clark S. Judd, Franklin E. Weaver and Leon H. French.

The Waterbury Brass Goods Corporation, subsidiary of the American Brass, elected officers as follows: President, John A. Coe; vice-presidents, Anson W. Miner and John P. Durfee; secretary and assistant treasurer, G. Burton Peck; treasurer, C. F. Hollister; directors, J. A. Coe, John P. Durfee, C. F. Hollister, C. S. Judd, F. E. Weaver and Edmund H. Yates.

The American Metal Hose Company, subsidiary of the American Brass, elected officers as follows: President, John A. Coe; vice-president, C. F. Hollister; secretary and treasurer, Charles S. Hungerford; assistant secretary and treasurer, John A. Locke; directors: J. A. Coe, C. F. Hollister, E. H. Yates, C. S. Hungerford, F. E. Weaver and C. S. Judd.

—W. R. B.

Connecticut Notes

MARCH 1, 1930.

HARTFORD—After dividends amounting to $662,489 and $11,100 for retirement of preferred stock and adjustment for federal taxes, **Arrow-Hart and Hegeman** added $68,361 to surplus according to its financial statement for 1929. During the year 2,500 shares of preferred stock were retired. The total surplus is now $3,381,219 and total assets, $9,085,421. Officers and directors were reelected.

Earnings of **Veeder-Root, Inc.,** during 1929, were at the rate of $5.01 a share compared with $3.90 a share for 1928. Net earnings transferred to surplus were $189,460, making a total surplus of $2,458,302.

Billings and Spencer Company has opened its New York office and warehouse at 53 Warren street. **W. Roy Moore** will be the manager.

Officers of the **Smyth Manufacturing Company** were re-elected last month as follows: President, M. S. Little; vice-president, Ian Mackenzie; secretary and treasurer, Charles P. Cooley.

BRIDGEPORT—**The Raybestos-Manhattan Company** of Bridgeport has acquired all the stock of **Wright & Corson Company,** rivet manufacturers of Milford. The latter company recently moved into a new $250,000 plant. **Frederick Merwin** will continue as president and **Sumner Simpson,** president of the local concern, will become vice-president.

Remington Arms Company is issuing $3,000,000 of three-year 5½ per cent gold notes.

BRISTOL—Officers and directors of the **Bristol Brass Company** were all re-elected last month. The company reports net profits after depreciation and tax reserves of $418,047 compared with $355,803 last year. The surplus is increased from $227,259 to $853,101. President Harper states the liquidating value of the stock is $41 per share compared to $31 a year ago. Preferred stock to the amount of $33,000 was retired during the year and all accrued preferred dividends were paid up.

Officers and directors of the **American Silver Company** were all re-elected last month.

NEW BRITAIN—The New Britain Machine Co. reports net profits for the year of $610,795 compared with $603,185 a year ago. The surplus was increased $303,000, giving a net value share of $29. Dividends paid during the year amounted to $177,732 compared with $109,556 a year ago.

SOUTHINGTON—**The Atwater Manufacturing Company,** makers of automobile specialties, has been acquired by the **Tubular Products Company.** Benjamin Munch, president of the latter company, will become president of the former. He, with **Alfred Smith,** former president and treasurer of the Atwater Company, **James H. Pratt** and **Edwin S. Todd,** are directors of the Tubular concern. The former stock interests held in the Atwater Company by **Bradley H. Barner** and **Alfred M. Smith** were purchased by the Tubular company. The Atwater Company has averaged dividends amounting to 30 per cent during the last seven years.

The Plantsville Foundry Corporation, with a capital of $50,000, has been formed to take over the **Walker-Stewart Foundry.** The officers are: President, **Thomas Thomson;** vice-president, **Charles S. Persianni;** treasurer, **Thomas J. Aubrey;** secretary, **Victor Walker;** assistant treasurer, **Edward L. Sullivan;** directors, the above, and **C. Fay Curtis, C. I. Stone, George Smith** and **Boughton Noble.**

NEW HAVEN—Acme Wire Company had net earnings during 1929 of $446,148 after taxes and depreciation, but before dividends, compared to $290,658 in 1928, the best previous year. All preferred stock was retired during the year. It invested $104,578 in new equipment during the year The earnings equal $11 a share on the common stock outstanding.

Net earnings of the **A. C. Gilbert Company,** makers of electrical devices, equaled $3.70 a share for 1929 after preferred dividends were paid, compared with $2.62 a share the previous year.

WINSTED—The Belden Manufacturing Company of Chicago has been granted a temporary injunction against the **Strand and Sweet Manufacturing Company** and the **Winsted Insulated Wire Company,** restraining the latter from disclosing information regarding alleged secret formulae and alleged special and secret machinery used for the manufacture of enamel wire, which **Ralph E. Strand** and **James E. Sweet** are alleged to have obtained while employed by the Belden Company previous to 1920. The latter company also demands an accounting of profits, claiming the trade secrets are worth more than $500,000 and that it has suffered injury of more than $1,000,000.

—W. R. B.

Providence, R. I.

MARCH 1, 1930.

Esther's Lacquering & Finishing Co. has changed its name to the **Enamel Crafts Corporation** and its capital stock increased from 300 shares of common no par value to 300 shares of common no par.

New England Lacquer Co. of East Providence has filed notice with the Secretary of State of a change in its capital stock from $30,000 to $20,000 preferred and 302 shares of common of no par value.

The T. S. Bennett Findings Company, Inc. of Providence has been incorporated under the laws of Rhode Island to manufacture jewelry and jewelers' findings with an authorized capital consisting of 600 shares of common of no par value. The incorporators are: Thomas S. Bennett, Saran M. Bennett and Harry A. Ormiston all of Providence.

—W. H. M.

Middle Atlantic States

Trenton, New Jersey

MARCH 1, 1930.

Another industry has selected Trenton as its place of operation. The concern is the **Moss Filled Wreath Company,** of which Harry M. Curran, of Chicago, is president. The company has leased quarters in the Maddock building on Muirhead Avenue. Specially built machinery will be installed as quickly as possible and it is the intention to have the industry in full operation in about ninety days. About 50 persons will be employed. The company will manufacture wreath frames and other metal background forms used by florists. The moss that will be used in the completion of the product is grown in New Jersey.

Construction of a $350,000 addition to the **Riverside Metal Company's** plant at Riverside, N. J., which was started recently, is expected to be completed in about five months. The new building will increase the employment in the plant from about 500 persons to 625, according to **John F. Hackett,** general manager of the company. The structure will cover about 60,000 square feet. It is appended on the eastern end of the present metal company building. The Riverside company is a companion organization of the **Keystone Watchcase Company.** The two factories are side by side and use the same entrance. Much of the metal refined by the metal company is used in the watchcase factory.

The Wherry and Hutchinson Company is now occuping the new warehouse and salesrooms on West Hanover Street. The structure is of two-story brick with offices on the second floor. The firm was established nearly three years ago and wholesales electrical supplies and radios. The concern intends to increase its lines. **William G. Wherry,** president of the **Skillman Hardware Manufacturing Company,** is head of the company.

William Prim of America will erect a metal products plant at New Brunswick, N. J., 2 stories, brick and steel, to cost $1,000,000.

Following concerns have been chartered at Trenton: **Step Rods Manufacturing Company, Inc.,** household hardware, $25,000, Bogota. **Alloys Foundry Corporation,** foundry castings, $25,000, Jersey City. **Union Metals Company, Inc.,** metal products, 2,500 shares no par, Linden. **Kroll and VanErmen,** silverware, $25,000, Montclair. **Ocean Chemical Company,** chemicals, 1,000 shares no par, Atlantic City. **Refined Chemical Corporation,** chemicals, 1,000 shares, Lyndhurst.—C. A. L.

Newark, New Jersey

MARCH 1, 1930.

Vice Chancellor Church has appointed three receivers for the **Kolster Radio Corporation** which, according to a report submitted to the court, has assets exceeding its liabilities, but because of overproduction lacks cash for current obligations. The receivers are **Harry G. Hendricks,** Newark; **Harry Meyers,** Passaic, N. J., and **Ellery W. Stone,** president of the Kolster Corporation. **Frederick J. Faulks,** representing the company, told the court his investigation disclosed a preponderance of assets and stated he was of the opinion it will not be long before the company is reorganized and restored to a paying business. The receivers were appointed on a bill entered in behalf of **Jacob Meyer,** holder of 100 shares in the company.

The Westinghouse Electric and Manufacturing Company, 150 Broadway, New York has plans drawn for a two-story and basement, brick and steel building for the State Highway and Haynes Avenue, Newark, to cost $150,000. **The Sonatrom Tube Company,** of 52 State Street, Newark, will erect a factory, 6-story and basement, 68 by 120 feet at 82 Eighth Avenue, to cost $175,000. **The New Jersey Art Foundry,** 433 Tonnele Avenue, Jersey City, will build a one-story, brick and steel foundry at that address to cost $40,000. **The Westinghouse Lamp Company,** Clearfield Avenue, Bloomfield, N. J., will erect a five-story building, 60 x 175 feet, for the manufacture of wire products for lamps. The building will cost $700,000.

Following Newark concerns were recently incorporated: **Thomas E. Day, Inc.,** foundry, $50,000. **Julius Joachimsthal Company,** metals, $100,000. **Chemical Laboratories of America,** chemicals, $200,000. **Cadmium Corporation,** chemicals, $100,000. **Prudential Radio Tube Corporation,** manufacture radio tubes, $20,000. **Henry I. Schneider, Inc.,** manufacture jewelry, $50,000. **Walter Jewelry Manufacturing Company, Inc.,** $125,000. **Stone Fog Light Corporation, of New Jersey,** manufacture lights, 2,500 shares common.—C. A. L.

Middle Western States

Detroit, Michigan

MARCH 1, 1930.

Conditions in the non-ferrous industry have not shown the revival in February expected earlier in the winter. In fact, this is true of nearly all lines of industry. Manufacturing is not what it should be at this season of the year. General conditions are so much different this season from those of other recent years that no one lays much stress on forecasts.

The motor car industry on which so much depends in the Detroit area is still decidedly quiet, although there is some indication of increased production. However, none of the plants are operating at capacity and most of them are operating part-time.

The airplane plants are showing some progress. This industry promises to show decided strides during the early spring and summer months.

The plating industry is having a fair run of business. Some of the plants are operating at capacity, although others are not as busy as might be desired at this time of the year.

The Hutchinson Welding Company, 1314 Fourth Street, has recently been incorporated. Capital is $10,000 and 1,000 shares of no par value.

Interstate Brass and Copper Company, 6631 East Jefferson Avenue, is a new Michigan organization. Capital stock is $50,000.

Grand Rapids Welding Supply Company, with headquarters at Grand Rapids, Mich., has recently increased its capital stock from $50,000 to $100,000. The increased capital, it is understood, will be used for expansion purposes.

Stinson Aircraft Corporation, subsidiary of the **Cord Corporation,** announces that it plans to manufacture and market 300 units of the "Stinson Journal" model, a four passenger cabin craft, at a new low price of $5,775. Cabin planes in this class previously sold for between $10,500 and $12,500.

Effective February 10, the Detroit district sales offices of **Cutler-Hammer, Inc.,** manufacturers of electric control apparatus, will be located at 2755 East Grand Boulevard. De-

troit. The new location also includes warehouse facilities.

The "Strombos" locomotive whistle is being manufactured in a steadily increased volume in order to meet the demand, according to **J. Thomas Rhamstine,** manufacturer, whose plant is located at 500 East Woodbridge street, Detroit. Many of the largest railroads in the United States are using "Strombos" signals. They are said to effect a fuel saving of $2.50 a day.

Oakland Motor Car Company has recently furnished all workmen operating its new carbon arc welding equipment with metal masks, protecting the face and neck from the violet rays. **A. A. Vitt,** safety inspector, discovered that the arc welding equipment produced a radiant "sun tan" on the operators. With this new equipment it is possible for the Oakland workmen to weld the two halves of the Oakland banjo-type rear axle housing in one operation. Upon completion of the installation, four of these new arc welding machines will be in operation, working in pairs. Each of the machines is enclosed in a seven-foot corrugated metal partition in order to protect the eyes of near-by workers from the powerful violet rays.

A Detroit group, it is announced, recently organized the **Essex Wire Corporation,** with capital stock of $1,000,000 for the purpose of operating the wire plant in Highland Park, Mich., which has been relinquished by **Ford Motor Company. Addison E. Holton,** president and treasurer of **Holton and Company,** a Detroit automobile firm, heads the new wire concern, it is announced. **Harold A. Strickland** is vice-president and general manager. According to Mr. Holton, when this new organization gets into full production it will employ 1,000 men. Under the Ford company the plant employed from 500 to 600 men. The company is engaged in the manufacture of ignition wire, wire assemblies, battery cables, bare copper wire, and magnet wire for automobile manufacturers.

Earnings statement of the **Campbell, Wyant and Cannon Foundry Company,** Muskegon, Mich., probably will show a net income after all charges equivalent to between $3.65 and $3.70 a share on the outstanding stock, it was recently announced. January business is reported to have been 90 per cent of the volume for the same month in 1929.

Mueller Brass Company, Port Huron, recently completed the biggest year in its history with business totaling $7,290,461. Prospects for 1930 are reported as good, with $1,000,000 in orders now on books. The company spent approximately $250,000 in 1929 for new buildings, improved machinery and equipment. It is now entering a new field with a new pipe fitting and special pipe intended for industrial and plumbing use, which will broaden the business to a great extent, it is announced.

Bassett Foundry Company, Adrian, Mich., was recently incorporated. It is making castings from non-ferrous and other metals. The owners are **Isaac Bassett, W. H. Burnham,** and **Carroll W. Bassett.** —F. J. H.

Wisconsin Notes

MARCH 1, 1930.

The Kinite Corporation of Milwaukee, makers of alloy steel castings, bar stock and vanadium nickel alloy, have increased their manufacturing facilities by the addition of the Toledo foundry of the Owens-Illinois Glass Company. According to **P. H. Dorr,** president, the Milwaukee Kinite foundry will be operated as usual.

George Vits was re-elected president of the **Aluminum Goods Manufacturing Company,** of Manitowoc and Two Rivers. **R. J. Findlan** was renamed secretary-treasurer, and **Carl F. Isselman** was again chosen assistant secretary.

Remus Koenig, Two Rivers, was elected a member of the board of directors, succeeding his father, **Joseph Koenig,** who died a few months ago. Other members of the board besides George Vits are **A. J. Vits,** Manitowoc; **J. E. Hamilton,** Two Rivers; and **Arthur V. Davis** and **Roy Hunt,** Pittsburgh, Pa. During 1929 the company built a seven-story office building and a five-story plating plant and additions to its two plants at Two Rivers at a total cost of $809,909. The report shows that the company has no fixed debts or preferred stock outstanding.

Following are the officers of the **Master Sheet Metal Contractors' Association,** which met at the Milwaukee Auditorium the end of January: **Henry Geussenhainer,** Sheboygan, president; **Paul Biersach,** Milwaukee, secretary; **Alfred C. Goethel,** Milwaukee, treasurer; **R. C. Suettinger,** Two Rivers; **Louis Reinke,** Milwaukee; **George Bischoff,** Marinette; **Nic Ording,** Sheboygan; and **George C. Peterson,** Milwaukee, vice-presidents. —A. P. N.

Other Countries

Birmingham, England

FEBRUARY 21, 1930.

In the non-ferrous metal rolling trades business has been slow since the opening of the year and prominent manufacturers consider that there will be no brisk flow of trade until copper is cheaper. Some headway is being made in the Canadian market, although export business generally is difficult in view of the keen competition from European countries.

As usual, there was a large representation of non-ferrous metal firms at the Birmingham Section of the **British Industries Fair,** held from February 17 to 28. Under the group known as "Metals," all kinds of ferrous and non-ferrous metals and alloys, plates, sheets, castings, forgings, stampings, pressings, wire, rods, tubes and fittings and stainless metal were shown, while in the group known as "Hardware, Ironmongery and Brass foundry," there were many descriptions of metal furniture. The Fair was substantially larger than that of last year, which was a record. The space area of the exhibition hall, the largest under one roof in the country, was 214,000 square feet, this representing an increase of 15,000 square feet. A thousand firms exhibited and the lines of stands had a total length of 3½ miles.

The London section of the Fair, held simultaneously at Olympia, had examples from the silver and electroplate and jewelry trades, where many Birmingham firms were represented.

The electroplate trade in Birmingham is experiencing a quiet period. Preparations are being made for the Spring business as firms usually send their travellers out to Canada by Whitsuntide. A fair amount of export trade is being done and some of the local makers contend that this is the mainstay of their industry. A good deal of home business has been taken by the vogue for cut glass and pewter, both of which are still exceedingly popular on English tables. Electroplate, however, is being used to an increasing extent in the Far East. China recently placed some important orders with Midland firms. In the jewelry trade generally there is still complaint of the difficulty of obtaining skilled labor. This is a serious problem whenever an urgent order comes in.

A Birmingham member of Parliament has introduced the Fanc Fancy Jewelry (Standard Trades Descriptions) Bill into the House of Commons. Its purpose is to amend the Merchandise Marks Acts (1887-1911) and to define certain trade descriptions as applied to articles in the fancy jewelry and allied trades. The bill proposes to give statutory meaning and effect to certain terms current in the fancy jewelry and allied trades, such as "gold front," "rolled gold," "gold filled" and others. Purchasers have at present no indication of the real nature of the article and the result is frequent deception of the public and a demoralizing competition within the trade The meanings of these descriptions were long since agreed upon by practically the whole trade after careful consideration and a good deal of research.

Bodies with far reaching ramifications, such as the **Birmingham Jewelers and Silversmiths Association,** the **London Wholesale Jewelers and Allied Trades Association** and the **National Association of Goldsmiths** and others have been

in agreement on the subject for a considerable time. It is pointed out that in Canada legislation has been adopted on goods of this class in the **Precious Metals Acts.** An international conference of gold, silver and allied trades, representing 22 nations, has had the matter under consideration and the bill has been approved by the **Worshipful Company of Goldsmiths,** the **Customs,** the **Board of Trade,** and the **Law Society.** The Bill has been read a first time in Parliament.

"Chrome Plating" was the subject of an address given recently by E. J. Dobbs, the chief chemist of **W. Canning and Company, Ltd.,** the well known manufacturers of plating apparatus. The tendency of some chromium deposits to crack and also the stresses set up in the underlying metals were considered, said the speaker, to be due to occlusion of hydrogen in deposits, occasioned by excessive current density. The ideal chromium solution was one that worked at a low current density with a high efficiency giving rise to increased throwing power over solutions in general use in the United States. The speaker made it clear that a heavy deposit of nickel was essential upon the base metal if the chromium deposit was to be endured. In spite of claims advanced for the practice of depositing chromium direct in commercial thickness, any chromium deposit so made broke down badly when exposed to climatic influence. Chromium plating was quite a simple operation, he said, as was nickel plating, if due care was exercised in the provision of adequate contacts and the essential conditions of temperature and current density were maintained.

Professor D. Hanson, who is the Feeney Professor of Metallurgy at Birmingham University, recently lectured to the **University Metallurgical Society** on "Research in the Metallurgical Department." Professor Hanson emphasized the value of research in the University, first because of its influence upon teaching, and second because of its value to industry. The University was well equipped to undertake work in connection with manufacturing processes, and in the past year or so had contributed its share to the development of new alloys, he said. For example, aluminum bronze, aluminum brass, ternary lead alloys for cable sheathing and pipes, and alloy cast irons. Development work on those materials had been carried out in the University and had assisted in getting them brought into use, he declared.—J. A. H.

Business Items—Verified

Western Foundry Company, Kedzie avenue at Thirty-sixth street, Chicago, Ill., recently completed a new addition to its plant.

King's Enamel and Silverware, Inc., 7-11 West forty-fifth street, New York, has been established by Miss A. F. King, to specialize in handmade enameled sterling silver and gold boudoir sets in distinctive designs.

Ferro Enamel Supply Company, Cleveland, Ohio, have just received an order from the **Wrought Iron Range Company,** St. Louis, Mo., for one oil-fired continuous type enameling furnace, to be installed in the very near future.

R. J. Letcher & Son, Fourth avenue, Asbury Park, N. J., has decided to hold up its projected expansion plan covering construction of a new storage and shop building. The company manufactures plumbing equipment and supplies.

Reading Chain and Block Corporation, Reading, Pa., has increased the staff of its Cleveland department by the addition of **W. C. Minier** and **F. C. Lorenz** to the engineering and sales staff there, under **George R. Harrison,** district manager.

All-Metal Lighting Fixture Company, New York, has leased a floor in building at 97-103 East Houston street for a new plant. The following departments are operated: soldering, plating, polishing, grinding room, lacquering, japanning.

The Modern Plating Co., Inc., 41 Hospital Street, Providence, R. I., has announced a new white finish for jewelry, trade-marked "Algolium." Many manufacturing jewelers have already adopted this finish because of its soft, pleasing tone and lasting qualities, the company reports.

Metalcraft Heater Corporation, Grand Rapids, Mich., is reported considering addition of one story at cost of about $30,000 with equipment. Company operates tool room, spinning, stamping, brazing, polishing, lacquering and japanning departments. **C. V. Marshall** is general manager.

C. R. Percival, 248 Lafayette Street, New York, is now manufacturers' agent for the Sulphur Products Company, Greensburg, Pa., producers of McKeon's "Liquid Sulphur" oxidizing agent. Mr. Percival, who is well known to the plating and finishing industry, will stock this product at his warehouse at the address given.

Springfield Bronze and Aluminum Company, Springfield, Mass., has completed an addition to their plants. The new construction includes foundry addition, new pattern shop, new pattern storage and metal storage, new chemical and physical laboratory and new office. This firm operates brass, bronze and aluminum foundry.

Urquhart Foreign Trade Counsel and Service, 11 West 42nd street, New York, has been organized by **W. L. Urquhart,** to carry on a complete sales counsel and service for development of foreign trade. Mr. Urquhart was formerly a partner in Droosten & Urquhart, New York, and has had much experience as an export sales manager.

Plans are being made by the **Tennessee Stove Works,** Chattanooga, Tennessee, to build an additional enameling plant at a cost of $200,000, according to **Ben M. Rawlings,** representative. The plant will be equipped with a 240-kilowatt continuous electric enameling furnace to be installed by the **Ferro Enamel Supply Company,** Cleveland, Ohio.

Edgely Brass Company, Edgely, Pa., has been incorporated with $50,000 to make castings, tools and fixtures and conduct a machine shop and foundry. **F. A. Barton,** Mercerville, N. J., is president. The following departments are operated: Brass, bronze and aluminum foundry; brass machine shop, casting shop, plating, polishing, grinding room, lacquering, japanning.

B. W. Burridge Company, 130 Hayes street, San Francisco, Cal., have opened a new plant at the above address, consisting of a 2-story reinforced concrete building having 6,500 square feet of floor space. The company will operate a complete and modern job plating plant, producing silver, gold, nickel, and chromium finishes, etc. Company was established in 1887 and has grown steadily.

The Foxboro Company of Foxboro, Mass., announces the removal of their Los Angeles office at 2307 East Eighth street. This office has been reorganized for the purpose of assuring Southern California the same Foxboro engineering service enjoyed by other sections of the country. **D. M. Hill** will be in charge, assisted by an entirely new staff of trained and experienced engineers.

Zucker Sons' Company, Roselle, N. J., manufacturers of "Pioneer" brand rouge and composition for polishing, buffing, etc., have let a contract for a plant addition which will afford an increase of about 50 per cent in manufacturing space. The warehouse space was recently increased about fifty per cent also. The expansion is stated to have been made necessary by rapidly increasing demand for the company's products.

H. H. Franklin Manufacturing Company, Syracuse, N. Y., has acquired complete control of the **Franklin Die Casting Corporation** in that city, according to a director's announcement. Officers elected at the annual meeting are: **L. J. Purdy,** president; **R. O. Brown,** vice-president; **F. A. Barton,** treasurer, and **J. E. Halligan,** secretary. The following departments are operated: tool room, plating, polishing, grinding room, lacquering.

The Walter S. Wood Company, Boston, Mass., announces the discontinuance of its relation as distributor for Hanson-Van Winkle-Munning Company, Matawan, N. J., and the establishment of exclusive sales agreements with **Eager-Electric Products Company,** Cleveland, O., generator manufacturers; **J. B. Ford Company,** Wyandotte, Mich., cleaner manufacturers; and **Matchless Metal Polish Company,** Glen Ridge, N. J., manufacturers of polishing compositions. The company is making further connections with manufacturers of other products. By combining the units of specialization made avail-

able by these connections, the Walter S. Wood Company intends to offer a complete service in the plating and polishing field.

R. Lavin and Son, producers of brass and copper ingots, have purchased leasehold interests at 3426 South Kedzie avenue, Chicago, Ill. The buildings are 85 x 603 ft., 82 x 263 ft., and 40 x 131 ft. The Lavin company expects to spend about $20,000 on improvements and will move from its present location at 2511 West Twenty-first street, shortly. The following departments are operated: smelting and refining; brass, bronze and aluminum foundry.

The Billings and Spencer Company, Hartford, Conn., manufacturers of forgings, forged tools, machinery, etc., have opened a New York office and warehouse at 53 Warren street, in charge of **W. Roy Moore,** metropolitan sales manager. A complete stock of the company's products will be carried, as well as a complete line of sockets, extensions and kindred tools manufactured by the **Husky Corporation,** Kenosha, Wis., for whom the Billings company is sales representative.

Increasing volume of business in Southern California territory is the reason for the establishment of a new and thoroughly complete sales and service branch by **The DeVilbiss Company** at 2305 East 8th street, Los Angeles, Calif. **R. J. Burns** is manager of the new Los Angeles branch. The DeVilbiss Company, Cleveland, Ohio, manufactures and sells spray-painting and spray-finishing outfits and equipment for all industries and uses, exhausting equipment, air compressors, and air and fluid hose.

Review of the Wrought Metal Business

By J. J. WHITEHEAD

President of the Whitehead Metal Products Co. of New York, Inc.

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

MARCH 1, 1930.

Contrary to general belief, the first three weeks of February did not markedly clarify the situation or indicate a tremendous immediate upturn in business. Confidence is gradually returning, and it is believed that by April more definite indications of a business revival will be apparent Even at this writing, the demand for copper and brass is showing quite a little improvement. Certainly operations at mills are greater than since last fall, and everyone is hopeful that the situation will soon improve to such an extent that business may again be considered normal.

The price of copper is 18c and there is no indication that it will be reduced in the immediate future. The metal trades are beginning to appreciate the stable price of the metal, and if copper will only continue to remain at 18c, and there is every reason to believe that it will, the producers will soon be thanked by everyone using copper. As time goes on and everyone begins to realize and understand the advantages of stabilization, they will wonder how they could ever have wanted to reestablish the old practice of wildly fluctuating prices. As the 18c price continues in force, more and more companies, particularly users of copper for manufactured products, are beginning to understand what the efforts of the producers have meant for their business. It would almost seem that the copper industry has taken the lead and shown other industries the way. Ultimately, all industry in the Unted States will be stabilized on some plane and held there.

The stocks of copper during January showed a further increase to about 203,000 tons from 178,000. This is the largest amount of metal stocked by producers for many years. As a result, production has been cut materially. It is probable that the stocks of metal for February will show a further slight increase, but it is safe to say that if the stocks do increase for February, any further increase in succeeding months is unlikely.

The demand for nickel shows no abatement and it is advisable for users to anticipate their needs well in advance. If business activity shows a marked upturn in the near future, purchasers of nickel should immediately cover their needs.

The demand for monel metal is good, production is normal and the situation is very healthy indeed. Deliveries may be obtained within a reasonable time.

Cheaper money is starting to have its effect on the building industry and there is every reason to believe that by the first of next month the situation will have shown a great deal of improvement.

If the price of commodities continues to fall, it is not improbable that there will be further cuts in the rediscount rate and, of course, still lower money rates. The worst part of the readjustment is past and from now on it is simply a question of how rapid the recovery is going to be. With minimum stocks it is certain that the longer it is delayed the more rapid it will be when it once gets underway.

Metal Market Review

By R. J. HOUSTON

D. Houston and Company, Metal Brokers, New York

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

COPPER

MARCH 1, 1930.

The market's ability to hold its ground has been an outstanding feature. This has been demonstrated in the face of the largest surplus stocks since May, 1922. Holdings of refined copper in primary hands on February 1 amounted to 203,404 short tons compared with 171,320 tons on January 1, an increase of 32,084 tons. This large accumulation has operated as a powerful incentive for consumers to keep supplies on hand down to the minimum and to buy only as needs develop. Meantime producers are curtailing output sharply as an economic measure for correcting an unfavorable technical condition. Certainly such action is needful to bring about a sound balance between production and consumption. A program of conservation of natural resources is a fundamentally sound policy.

The trend of the market has been steady at 18 cents Connecticut delivery and 18.30 cents c. i. f. European ports.

ZINC

Although prices of zinc have declined to 5.15c. East St. Louis the market does not show any very encouraging improvement, at least as regards values. Buyers have been apathetic in their attitude.

Production has been increasing too fast for the absorbing power of consumption. Current prices look like bargain values, but consumers have their eye specially on capacity output and the potentialities involved. Domestic users are pretty well covered on nearby and future requirements. Smelters stocks on February 1 were 87,933 tons, being an increase of 10,671 tons during January. A year ago stocks were only 45,418 tons.

TIN

A good deal of activity transpired in tin during the past month. Consumers bought substantial tonnages for prompt and nearby de-

liveries at the market range between 38½c. and 39c. for Straits. Conservation is being carried out at different sources of production, and restriction in output is depended upon to prevent excessive market depression. Present supplies, however, are too large to permit much higher values. Total visible supply amounted to 29,032 tons on February 1 as compared with 24,237 tons at the corresponding time a year ago. American tin deliveries in January were 5,815 tons, against 8,795 tons in January, 1929. New supplies coming into sight recently were greater than the deliveries. Present price of prompt Straits tin is about 10 cents a pound less than that a year ago.

LEAD

Active buying of lead featured the movements of the metal last month. Buying was particularly brisk early in February when consuming industries placed orders for heavy tonnages. A good scale of buying was also maintained during the rest of the month. Fulfilling expectations, production and stocks of lead have decreased lately so that the present statistical position is regarded as much more sound than it was. The tone of the market is steady at 6.10c. East St. Louis and 6.25c. New York. Leading consumers have covered important requirements for nearby and March shipments. Total stocks of lead in the United States and Mexico on January 1 amounted to 151,586 tons, being the lowest in more than two years. Stocks of refined and antimonial on February 1 showed a decrease of 5,010 tons since January 1. There was also a decline of 6,329 tons in December.

ALUMINUM

Market prices for virgin aluminum are unchanged, but domestic consumption is reported considerably below that of a year ago. Improvement in demand is looked for as favorable developments appear in automobile production. A reduction in tariff rates has been proposed and passed in the Senate at Washington. The trade is somewhat uncertain as to the effect of lower duties should they be enacted into the final rates. Large quantities of aluminum were recently shipped to Japan from Canada.

ANTIMONY

Demand for antimony was on a moderate scale, but trading in the article is restricted owing to tariff apprehensions and uncertainties. Market prices quote 5.75c. to 5.85c. c. i. f. New York for China shipment and the tone firm. Prompt delivery of Chinese regulus quotes 9 cents per pound duty paid. China offers appear attractive, but the undeterminate provisions of the proposed tariff bill involve so much uncertainty that buyers hesitate to buy future positions. There are large shipments due to arrive here in March. Shipments of antimony regulus from China to the United States in 1929 amounted to 7,589 long tons.

QUICKSILVER

A fair demand was noted recently for quicksilver, but market tone in domestic circles was easier at $122 to $123.50 per flask. The foreign quotation has been steady for some time.

PLATINUM

The situation in platinum shows a substantial decline in prices owing to an increase in supplies. Consumption has increased lately, but new sources of production are being developed in different parts of the world. Refined platinum is quoted at $55 to $56 per ounce.

SILVER

Recent events have demonstrated the continued depression in silver. Prices have sagged again to the all time low record of 42⅞ cents per ounce. The London and Far East situation is also weak. No support is in evidence at this writing. There has been some reduction in world output as per latest figures available, but United States and Canada showed an increase for January. Stocks in Shanghai and India are large, and consumption in the Far East is not expected to be as great as formerly.

OLD METALS

Business in old metals has been on a good scale. The movement of heavy copper and wire on domestic and foreign account was in excellent volume. The steady tone of new copper has greatly helped the outlet for old material. Refineries and exporters are active factors for selected grades imparting both strength and activity to the market. Lead and zinc scrap have also a fairly good outlet. Brass grades were in moderate demand for domestic and export shipment. Quotations named by dealers as a buying basis are 15¼c to 15½c for crucible copper, 13¼c to 13½c for light copper, 8c to 8¼c for heavy brass, 10¾c to 11c for new brass clippings, 4½c to 4¾c for heavy lead, 2¼c to 2½c for old zinc and 15½c to 15¾ for aluminum clippings.

Daily Metal Prices for the Month of February, 1930

Record of Daily, Highest, Lowest and Average Prices and the Customs Duties

	3	4	5	6	7	10	11	12*	13	14	17
Copper c/lb. Duty Free											
Lake (Del.)	18.00	18.00	18.00	18.00	18.00	18.00	18.00	.....	18.00	18.00	18.00
Electrolytic (f. a. s. N. Y.)	18.00	18.00	18.00	18.00	18.00	18.00	18.00	.....	18.00	18.00	18.00
Casting (f. o. b. N. Y.)	17.00	17.00	17.00	17.00	17.00	17.05	17.05	.....	17.05	17.00	17.00
Zinc (f. o. b. St. L.) c/lb. Duty 1¼c/lb.											
Prime Western	5.25	5.25	5.25	5.20	5.20	5.20	5.20	.....	5.15	5.15	5.20
Brass Special	5.35	5.35	5.35	5.30	5.30	5.30	5.30	.....	5.25	5.25	5.30
Tin (f. o. b. N. Y.) c/lb. Duty Free											
Straits	38.875	39.20	38.95	39.15	39.00	38.875	38.75	.....	38.50	38.625	38.75
Pig 99%	38.25	38.50	38.25	38.50	38.25	38.125	38.00	.....	37.75	37.875	38.00
Lead (f. o. b. St. L.) c/lb. Duty 2½c/lb.	6.10	6.10	6.10	6.10	6.10	6.10	6.10	.....	6.10	6.10	6.10
Aluminum c/lb. Duty 5c/lb.	24.30	24.30	24.30	24.30	24.30	24.30	24.30	.....	24.30	24.30	24.30
Nickel c/lb. Duty 3c/lb.											
Ingot	35	35	35	35	35	35	35	.....	35	35	35
Shot	36	36	36	36	36	36	36	.....	36	36	36
Electrolytic	35	35	35	35	35	35	35	.....	35	35	35
Antimony (J. & Ch.) c/lb. Duty 2c/lb.	8.75	8.75	8.75	8.75	8.75	8.75	8.75	.....	8.75	8.75	8.75
Silver c/oz. Troy Duty Free	43.625	43.125	43.375	43.375	43.50	43.75	43.375	.....	43.875	43.75	43.375
Platinum $/oz. Troy Duty Free	59.00	59.00	59.00	59.00	59.00	58.00	58.00	.....	58.00	58.00	58.00

	18	19	20	21	24	25	26	27	28	High	Low	Aver.
Copper c/lb. Duty Free												
Lake (Del.)	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00
Electrolytic (f. a. s. N. Y.)	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00
Casting (f. o. b. N. Y.)	17.00	17.00	17.00	17.05	17.05	17.05	17.05	17.05	17.25	17.25	17.00	17.034
Zinc (f. o. b. St. L.) c/lb. Duty 1¼c/lb.												
Prime Western	5.20	5.15	5.15	5.15	5.15	5.15	5.125	5.10	5.10	5.25	5.10	5.175
Brass Special	5.30	5.25	5.25	5.25	5.25	5.25	5.225	5.20	5.20	5.35	5.20	5.275
Tin (f. o. b. N. Y.) c/lb. Duty Free												
Straits	38.75	39.00	39.00	38.75	38.35	38.15	38.25	38.00	37.75	39.20	37.75	38.667
Pig 99%	38.00	38.25	38.25	38.00	37.60	37.375	37.50	37.25	37.00	38.50	37.00	37.933
Lead (f. o. b. St. L.) c/lb. Duty 2½c/lb.	6.10	6.10	6.10	6.10	6.10	6.10	6.10	5.95	5.95	6.10	5.95	6.084
Aluminum c/lb. Duty 5c/lb.	24.30	24.30	24.30	24.30	24.30	24.30	24.30	24.30	24.30	24.30	24.30	24.30
Nickel c/lb. Duty 3c/lb.												
Ingot	35	35	35	35	35	35	35	35	35	35	35	35
Shot	36	36	36	36	36	36	36	36	36	36	36	36
Electrolytic	35	35	35	35	35	35	35	35	35	35	35	35
Antimony (J. & Ch.) c/lb. Duty 2c/lb.	8.75	9.25	9.25	9.25	9.00	9.00	9.00	9.00	9.00	9.25	8.75	8.895
Silver c/oz. Troy Duty Free	43.50	43.125	42.875	43.25	43.00	42.875	42.50	42.25	40.875	43.875	40.875	43.125
Platinum $/oz. Troy Duty Free	56.50	56.50	56.50	56.00	56.00	56.00	56.00	56.00	56.00	59.00	56.00	57.395

*Holiday.

Metal Prices, March 3, 1930

NEW METALS

Copper: Lake, 18.00. Electrolytic, 18.00. Casting, 17.25.
Zinc: Prime Western, 5.10. Brass Special, 5.20.
Tin: Straits, 37.45. Pig, 99%, 36.75.
Lead: 5.85. **Aluminum,** 24.30. **Antimony,** 8.875.
Nickel: Ingot, 35. Shot, 36. Elec., 35. Pellets, 40.
Quicksilver: flask, 75 lbs., $124.00. **Bismuth,** $1.70.
Cadmium, 90. **Cobalt,** 97%, $2.60. **Silver,** oz., Troy, 39.875
Gold: oz., Troy, $20.67. **Platinum,** oz., Troy, $56.00.

INGOT METALS AND ALLOYS

Brass Ingots, Yellow	12¼to12½
Brass Ingots, Red	15½to15¾
Bronze Ingots	16½to19½
Casting Aluminum Alloys	21 to24
Manganese Bronze Castings	27 to39
Manganese Bronze Ingots	15 to19
Manganese Bronze Forging	35 to43
Manganese Copper, 30%	25 to35
Monel Metal Shot	28
Monel Metal Blocks	28
Parsons Manganese Bronze Ingots	16½to19¾
Phosphor Bronze	17 to21
Phosphor Copper, guaranteed 15%	21 to24
Phosphor Copper, guaranteed 10%	20½to23
Phosphor Tin, no guarantee	45 to60
Silicon Copper, 10%, according to quality	25 to35

OLD METALS

Buying Prices		Selling Prices
14 to14½	Heavy Cut Copper	15 to15½
13½to13¾	Copper Wire, mixed	14½to14¾
12 to12¼	Light Copper	13 to13¼
11 to11¼	Heavy Machine Composition	12 to12¼
7¾to 8	Heavy Brass	8¼to 9
6¼to 6¾	Light Brass	7¼to 7¾
11 to11¼	No. 1 Composition	12 to12¼
10 to10¼	Composition Turnings	11 to11¼
4⅜to 4⅞	Heavy Lead	5⅜to 5⅞
2½to 3	Zinc Scrap	3½to 4
15½to16	New Aluminum Clips	19½to20
10 to10¼	Scrap Aluminum, cast alloyed	15 to15¼
10½to11	Scrap Aluminum sheet (new)	13 to14
24 to26	No. 1 Pewter	29 to30
20 to21	Old Nickel Anodes	22 to23
20 to23	Old Nickel	22 to25

Wrought Metals and Alloys

COPPER SHEET

Mill shipment (hot rolled) .....27¾c. to 28¾c. net base
From Stock .....28¾c. to 29¾c. net base

BARE COPPER WIRE

19⅝c. to 19⅞c. net base, in carload lots.

COPPER SEAMLESS TUBING

29¼c. to 30¼c., net base.

SOLDERING COPPERS

300 lbs. and over in one order .....26¼c. net base
100 lbs. to 200 lbs. in one order .....26¾c. net base

ZINC SHEET

Duty on sheet, 2c., per pound — Cents per lb.
Carload lots, standard sizes and gauges, at mill, less 7 per cent discount .....10.50 net base
Casks, jobbers' price .....10.75 net base
Open casks, jobbers' price .....11.25to11.75 net base

ALUMINUM SHEET AND COIL

Aluminum sheet, 18 ga., base price, ton lots.....33.30c.
Aluminum coils, 24 ga., base price, ton lots.....31.00c.

ROLLED NICKEL SHEET AND ROD

Net Base Prices

Cold Drawn Rods.....	53c.	Cold Rolled Sheet.....	60c.
Hot Rolled Rods.....	45c.	Full Finished Sheet.....	52c.

BLOCK TIN SHEET

Block Tin Sheet—18" wide or less. No. 26 B. & S. Gauge or thicker, 100 lbs. or more 10½c. over N. Y. Pig Tin; 50 to 100 lbs., 15c. over; 25 to 50 lbs., 17c. over; less than 25 lbs., 25c. over.

SILVER SHEET

Rolled sterling silver 45.50c. per ounce, Troy upward, according to quantity.

BRASS MATERIAL—MILL SHIPMENTS

In effect April 16, 1929
To customers who buy 5,000 lbs. or more in one order.

	Net base per lb. High Brass	Low Brass	Bronze
Sheet	$0.23¼	$0.25	$0.26¼
Wire	.23¾	.25½	.26¾
Rod	.21¼	.25¾	.27
Brazed tubing	.30⅞	....	.35⅞
Open seam tubing	.31¼	....	.34¼
Angles and channels	.31¼	....	.34¼

BRASS SEAMLESS TUBING

28¼c. to 29¼c. net base.

TOBIN BRONZE AND MUNTZ METAL

Tobin Bronze Rod	25¾c. net base
Muntz or Yellow Metal Sheating (14"x48")	24c. net base
Muntz or Yellow Rectangular sheet other Sheating	25c. net base
Muntz or Yellow Metal Rod	22¼c. net base

Above are for 100 lbs. or more in one order.

NICKEL SILVER (NICKELENE)

Net Base Prices

Grade "A" Sheet Metal		Wire and Rod	
10% Quality	31⅜c.	10% Quality	34⅛c.
15% Quality	33c.	15% Quality	37¾c.
18% Quality	34¼c.	18% Quality	41c.

MONEL METAL, SHEET AND ROD

Hot Rolled Rods (base)	35	Full Finished Sheets (base)	42
Cold Drawn Rods (base)	40	Cold Rolled Sheets (base)	50

BRITANNIA METAL SHEET

No. 1 Britannia—18" wide or less, No. 26 B. & S. Gauge or thicker, 500 lbs. or over, 8c. over N. Y. tin price; 100 lbs. to 500 lbs., 10c. over; 50 to 100 lbs., 15c. over; 25 to 50 lbs., 20c. over; less than 25 lbs. 25c. over. Prices f. o. b. mill.

Supply Prices, March 3, 1930

ANODES

Copper: Cast	28c.	per lb.
Rolled, oval	27c.	per lb.
Rolled, sheets, trimmed	25¼c.	per lb.
Brass: Cast	27c.	per lb.
Zinc: Cast	12⅛c.	per lb.
Nickel: 90-92%	45c.	per lb.
95-97%	47c.	per lb.
99%	49c.	per lb.

Silver: Rolled silver anodes .999 fine are quoted from 46¾c. Troy ounce, upward, depending upon quantity.

FELT POLISHING WHEELS WHITE SPANISH

Diameter	Thickness	Under 100 lbs.	100 to 200 lbs.	Over 200 lbs.
10-12-14 & 16"	1" to 3"	$3.00/lb.	$2.75/lb.	$2.65/lb.
6-8 & Over 16	1 to 3	3.10	2.85	2.75
6 to 24	Under ½	4.25	4.00	3.90
6 to 24	½ to 1	4.00	3.75	3.65
6 to 24	Over 3	3.40	3.15	3.05
4 up to 6	¼ to 3	4.85	4.85	4.85
4 up to 6	Over 3	5.25	5.25	5.25
Under 4	¼ to 3	5.45	5.45	5.45
Under 4	Over 3	5.85	5.85	5.85

Grey Mexican Wheel deduct 10c per lb. from White Spanish prices.

COTTON BUFFS

Full Disc Open buffs, per 100 sections.

11" 20 ply 64/68 Unbleached	$22.90 to 27.56
14" 20 ply 64/68 Unbleached	33.98 to 37.59
11" 20 ply 80/92 Unbleached	26.66 to 28.78
14" 20 ply 80/92 Unbleached	39.28 to 43.49
11" 20 ply 84/92 Unbleached	34.47 to 40.16
14" 20 ply 84/92 Unbleached	51.91 to 60.34
11" 20 ply 80/84 Unbleached	34.31 to 35.60
14" 20 ply 80/84 Unbleached	50.85 to 53.60
Sewed Pieced Buffs, per lb., bleached	52c to 71c

CHEMICALS

These are manufacturers' quantity prices and based on delivery from New York City.

Acetone	lb.	.11-18
Acid—Boric (Boracic) Crystals	lb.	.08½
Chromic, 75 to 400 lb. drums	lb.	.19-21
Hydrochloric (Muriatic) Tech., 20 deg., carboys	lb.	.02
Hydrochloric, C. P., 20 deg., carboys	lb	.06
Hydrofluoric, 30%, bbls.	lb.	.08
Nitric, 36 deg., carboys	lb.	.06
Nitric, 42 deg., carboys	lb.	.07
Sulphuric, 66 deg., carboys	lb.	.02
Alcohol—Butyl	lb.	.16¾-.21¼
Denatured, drums	gal.	.52-.60
Alum—Lump, barrels	lb.	.0325
Powdered, barrels	lb.	.039
Ammonium chloride, solution in carboys	lb.	.06½
Ammonium—sulphate, tech., bbls	lb.	3.3
Sulphocyanide	lb.	.65
Arsenic, white, kegs	lb	.05
Asphaltum	lb.	.35
Benzol, pure	gal.	.60
Borax Crystals (Sodium Biborate), bbls	lb.	.04½
Calcium Carbonate (Precipitated Chalk)	lb.	.04
Carbon Bisulphide, Drums	lb.	.06
Chrome Green, bbls.	lb.	.25
Chromic Sulphate	lb.	.30-.40
Copper—Acetate (Verdigris)	lb.	.23
Carbonate, bbls.	lb.	.21½
Cyanide (100 lb. kgs)	lb.	.45
Sulphate, bbls.	lb.	6.7
Cream of Tartar Crystals (Potassium Bitartrate)	lb.	.27
Crocus	lb.	.15
Dextrin	lb.	.05-.08
Emery Flour	lb.	.06
Flint, powdered	ton	$30.00
Fluor-spar (Calcic fluoride)	ton	$70.00
Fusel Oil	gal.	$4.45
Gold Chloride	oz.	$12.00
Gum—Sandarac	lb.	.26
Shellac	lb.	.59-.61
Iron Sulphate (Copperas), bbl.	lb.	.01½
Lead Acetate (Sugar of Lead)	lb.	.13¼
Yellow Oxide (Litharge)	lb.	.12½
Mercury Bichloride (Corrosive Sublimate)	lb.	$1.58
Nickel—Carbonate, dry bbls.	lb.	.35
Chloride, bbls.	lb.	.20
Salts, single, 300 lb. bbls.	lb.	.12½-.13
Salts, double, 425 lb. bbls.	lb.	.12½-.13
Paraffin	lb.	.05-.06
Phosphorus—Duty free, according to quantity	lb.	.35-.40
Potash, Caustic Electrolytic 88-92% broken, drums	lb.	.093
Potassium Bichromate, casks (crystals)	lb.	.09¼
Carbonate, 96-98%	lb.	.06¾-.07
Cyanide, 165 lb. cases, 94-96%	lb.	.57½
Pumice, ground, bbls.	lb.	.02½
Quartz, powdered	ton	$30.00
Rosin, bbls.	lb.	.04½
Rouge, nickel, 100 lb. lots	lb.	.25
Silver and Gold	lb.	.65
Sal Ammoniac (Ammonium Chloride) in casks	lb.	.05½
Silver Chloride, dry, 100 oz. lots	oz.	.37½
Cyanide (fluctuating)	oz.	.45-.50
Nitrate, 100 ounce lots	oz.	.32¼
Soda Ash, 58%, bbls.	lb.	.02½
Sodium—Cyanide, 96 to 98%, 100 lbs.	lb.	.17
Hyposulphite, kegs	lb.	.04
Nitrate, tech., bbls.	lb.	.04¼
Phosphate, tech., bbls.	lb.	.03¼
Silicate (Water Glass), bbls.	lb.	.02
Sulpho Cyanide	lb.	.32½
Sulphur (Brimstone), bbls.	lb.	.02
Tin Chloride, 100 lb kegs	lb.	.34
Tripoli, Powdered	lb.	.03
Wax—Bees, white, ref. bleached	lb.	.60
Yellow, No. 1	lb.	.45
Whiting, Bolted	lb.	.02½-.06
Zinc, Carbonate, bbls.	lb.	.11
Chloride, casks	lb.	.06¾
Cyanide (100 lb. kegs)	lb.	.41
Sulphate, bbls.	lb.	.03½